# The Digital Skill Standards
## ver.1.2

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Information-technology Promotion Agency, Japan

IPA

METI
Ministry of Economy, Trade and Industry

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# I. Overview of the Digital Skill Standards

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# Background and Aims of the Establishment of the Digital Skill Standards

## Increased importance of DX promotion at Japanese companies

- The evolution of data utilization and digital technology has resulted in the start of a shift toward an industrial structure that utilizes data and digital technology both in Japan and overseas. In order for companies to ensure competitive superiority against the backdrop of such a shift, it is important for them to always stay abreast of the ever-changing challenges faced by society and by their customers, and achieve digital transformation (DX[Note]).
- However, many Japanese companies are viewed as being late starters in their initiatives toward DX, and one of the main reasons given for this is a lack of human resources with a grounding or expertise when it comes to DX.

## The importance of human resources in DX promotion

- In order for a company to achieve DX, it is necessary for the company to raise its overall receptivity to transformation. As such, a situation must be achieved whereby each individual who belongs to the company, including the company's management, has a grounding in DX. That is to say, they should understand and have an interest in DX, and treat it as their own work. And having increased receptivity to transformation, the human resources with the related expertise need to play a key role in order for the company to actually put its DX strategy into effect.
- All employees therefore need to treat it as their own work, and every business person must acquire DX literacy in order for a company as a whole to increase its receptivity to transformation. A company also needs to recruit and develop human resources with expertise in order to concretely promote DX.

## Establishment of the Digital Skill Standards

- The Digital Skill Standards has been established to provide guidelines for individual learning and the companies' recruitment and development of human resources in light of the importance of human resources when it comes to the kind of DX promotion described above.
- The Digital Skill Standards is comprised of two parts: The DSS-L that provides guidelines for all business people to equip themselves with the fundamental knowledge, skills and mindset required for DX, and the DSS-P that provides guidelines for companies to recruit and develop human resources with expertise to promote DX.
  - ✓ The DSS-L: A standard for skills that all business people should equip themselves with
  - ✓ The DSS-P: A standard for the roles and required skills for the human resource types who will promote DX
- The knowledge and skills covered in the Digital Skill Standards are expressed in a general manner as far as possible, and the aim of this is to make them easily transferable as a common indicator while avoiding the requirement for any knowledge concerning a specific industry or job type when it comes to understanding the content. As such, it must be kept in mind that when applying the standard to an individual organization or company, it must be specifically tailored to the direction of the industry that the relevant organization or company belongs to, and the organization or company's own business.

Note: The definition of DX: In order to handle a rapidly changing business environment, a company transforms its products, services and business model based on the needs of its customers and society by utilizing data and digital technology, while also transforming its actual operations, organization, processes and corporate culture to establish competitive superiority (Ministry of Economy, Trade and Industry [Digital Governance Code 2.0] (Revised September 2022))

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# Approach to Revision of the Digital Skill Standards （1/2）

## Approach to revision

- It is anticipated that technologies with a social impact will appear and become prevalent in the medium to long term, and when they do, skills will need to be altered.
- The standards for the skills that all business people should equip themselves with, as well as the roles and required skills for the human resource types who will promote DX will continue to be reviewed in response to new technologies, changes in the industrial structure, government policies, and other events that affect DX. In doing so, consideration will be given to forecasts of their impacts in the short, medium and long term, consistency with the existing Digital Skill Standards, and their effects on users.
- More specifically, efforts will be made to popularize and utilize the Digital Skill Standards on the basis of collaboration with relevant ministries and agencies, and with the involvement of various private sector players, including education providers. In addition, ongoing reviews will be conducted, while obtaining feedback from users of the Digital Skill Standards, such as organizations/companies, individuals, and education providers.

## Purpose of most recent revision (August 2023)

- Rapidly spreading generative artificial intelligence (AI) is expected to accelerate the advancement of digital transformation (DX) in companies, and it has the potential to increase companies’ competitiveness.
- At the same time, the skills required of business people are expected to change, and some aspects of the skills are assumed to become more important than before.
- To address this situation, the requisite changes were made to the DSS-L.

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# Approach to Revision of the Digital Skill Standards （2/2）

## Purpose of the most recent revision (July 2024)

- **Revision on business architects** (addition regarding the Product Manager job title, which is similar to the Business Architect)
  - ✓ **Product managers, a job title similar to business architects, are becoming more common** in global standards and Japanese companies, especially those that provide digital services.
  - ✓ In response to the above-mentioned circumstances, this revision **defines a product manager as one of the human resources who promote DX; additions to the business architect human resource type have been made.**
- **Revision on generative AI**
  - ✓ Rapidly spreading generative artificial intelligence (AI) is expected to accelerate the advancement of digital transformation (DX) in companies, and it has the potential to increase companies' competitiveness.
  - ✓ Following the revisions made to the DSS-L (August of 2023) in order to reflect the changes that had occurred in the skills required of business people, **necessary changes (e.g., addition of supplementary information) were made to the DSS-P about actions required of human resources who promote DX.**
  - ✓ The necessity of attention to prevent incidents such as **the infringement of rights, information leakage and ethical issues** when using generative AI was also included as supplementary information.
  - ✓ This revision was made **based on the current situation of generative AI**, and the Digital Skill Standards will be reviewed on an ongoing basis as the situation around technological and legal developments changes.

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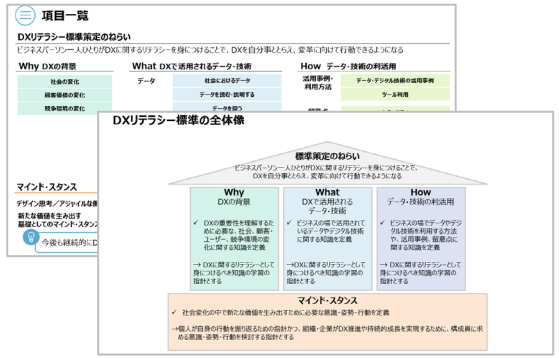
# Structure of the Digital Skill Standards

- The Digital Skill Standards is comprised of two standards: The DSS-L and the DSS-P. The former defines guidelines for all business people and defines learning subject examples accordingly, and the latter defines the roles of the human resources who promote DX and the requisite skills.

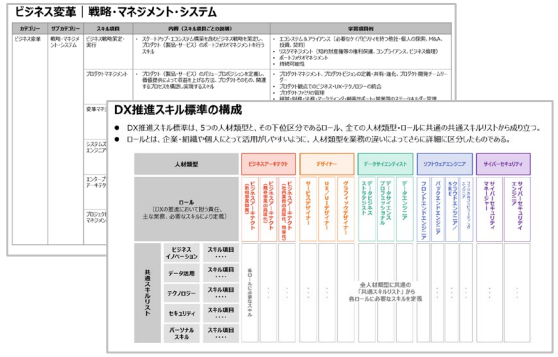
**The Digital Skill Standards**

**The DSS-L**




- This defines the following guidelines and the content that is expected to be learned in each guideline (learning subject examples).
  - Learning guidelines for knowledge to be obtained as DX literacy
  - Guidelines for individuals to reflect on their own actions, and guidelines for an organization or company to consider the mindset, approach and actions required of the people who constitute it

**The DSS-P**




- Defines the roles and required skills for each of the human resource types required for DX promotion (business architects/designers/data scientists/software engineers/cyber security).

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# Human Resources for Whom the Digital Skill Standards Is Intended

- The human resources for whom the Digital Skill Standards is intended are **those who belong to companies and other organizations using digital technology to increase their competitiveness**.
- Of these, the DSS-L is intended for all business people, while the DSS-P is intended for human resources who have expertise and will undertake DX initiatives at an organization or company (the human resources who promote DX).

## All business people (inc. management)

### <The DSS-L>

Defines the skills that all business people should equip themselves with

## Human resources who promote DX

### <The DSS-P>

Defines the roles and required skills for the human resource types who will promote DX

( Business architects/designers/
data scientists/software engineers/
cyber security )

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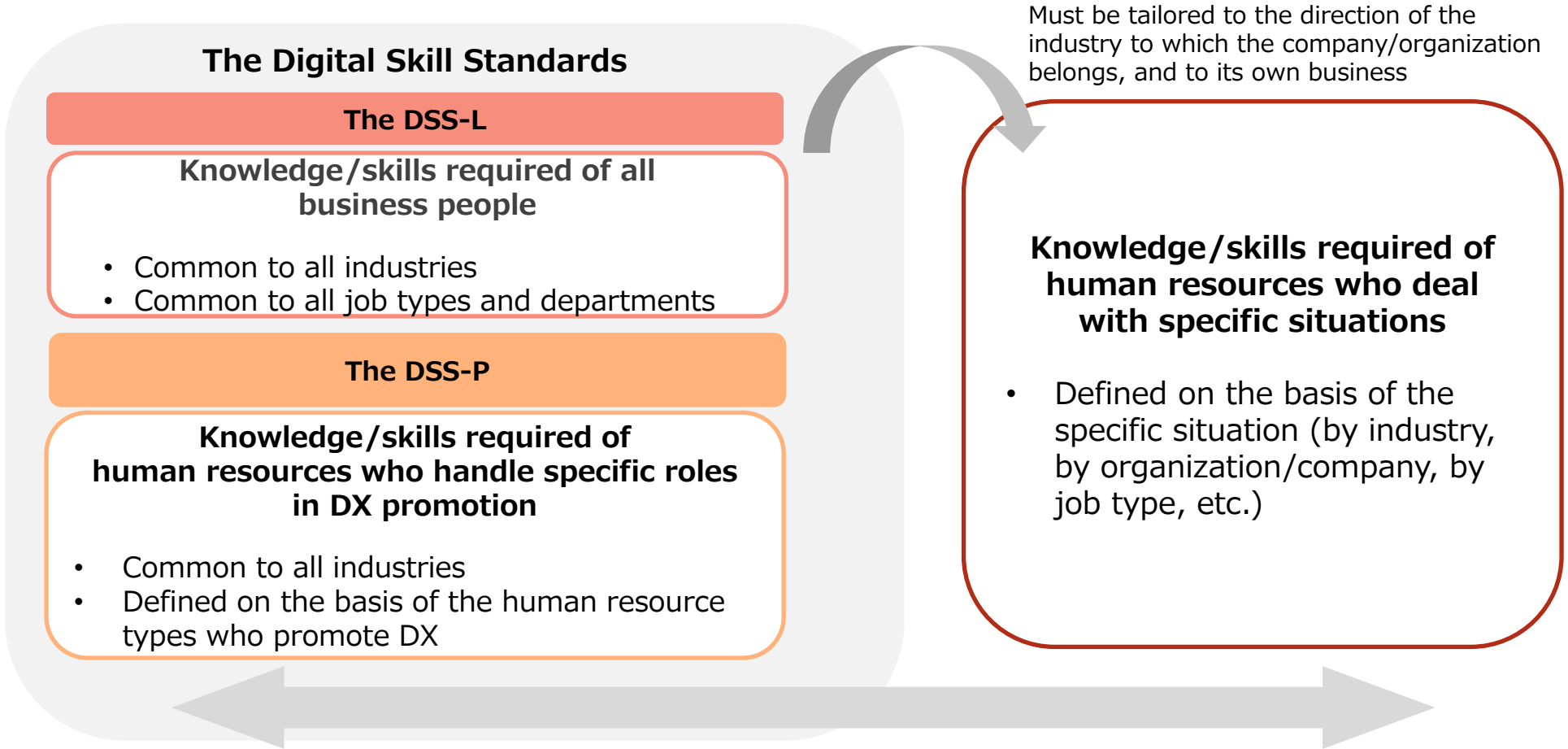
# General Applicability of the Digital Skill Standards

- The knowledge and skills covered in the Digital Skill Standards are expressed in a general manner as far as possible, and the aim of this is to make them easily transferable as a common indicator while avoiding the requirement for any knowledge concerning a specific industry or job type when it comes to understanding the content.
- As such, when applying the standard to an individual organization or company, it must be tailored to the direction of the industry to which the relevant organization or company belongs, and to that of the organization or company's own business.

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# How the Digital Skill Standards Can Be Utilized

- Promotion of DX by a company requires a cycle whereby the company undertakes initiatives for recruiting and developing human resources based on the companywide direction of DX and reviews its direction on the basis of what is achieved through this. In this cycle, the Digital Skill Standards provides support for undertaking human resource recruitment and development initiatives.
- It is not mandatory for a company to arrange all of the roles for DX promotion set out in the DSS-P from the start, and it is assumed that a subset of the roles will initially be established in accordance with the scale of business and progress of DX.

## DX vision/strategy

**Creation of a management vision to be achieved through DX**

- Design a management vision and business model in light of the impact of changes in society and the competitive environment due to digital technology
- Strategy to achieve the above and the required structure and organization, human resource recruitment and development policy, and policy for utilization of digital technology and other such things for its promotion

## Human resources

**Clarification of requirements for human resources who promote DX**

- What kind of knowledge and skills are required of the human resources who will promote a company's DX?

**Consideration of human resource recruitment and development measures**

- What mechanisms and measures are required in order to raise the level of the entire company and recruit and develop human resources who promote DX? (e.g.: development and hiring measures, review of the personnel system to enable the required human resources to perform to their full capability)

**Raising the level of the entire company (employees treating DX as their own work)**

- What mechanisms and measures are required to raise the level of the entire company? (ex: messages from management about the necessity of DX literacy, and companywide employee development measures)

**Digital Governance Code 2.0**
(Encourage s companies to undertake self-led and self-initiated DX initiatives)

**The Digital Skill Standards**
(Support for raising the level of the entire company, clarification of human resources requirements, consideration of human resource recruitment/development measures)

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# II. Digital Skill Standards for DX Literacy (DSS-L)

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# Chapter 1

# Aim of the DSS-L and Formulation Policy

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# Necessity of the DSS-L

To ensure that each and every business person can lead a better professional life at a time of environmental change and in a society where DX is being promoted, guidelines are required for the learning of knowledge and skills that also include matters that differ from what was conventionally considered common sense for working members of society

**Change in society**

**Amid increased awareness of the importance of sustainable growth initiatives (increased interest in the SDGs, ESG-focused investment, etc.), the value of solving various social issues is growing**

**Evolution of digital technology and advances in data utilization**

Due to the evolution of digital technology, a diverse array of data and technologies are broadening the possibilities for activities by business people, while at the same time stepping up the pace of change in society, customer value and the competitive environment

**Changes in customer value**

**It is not sufficient for quality to be good; customers now demand a high level of added value and products/services that appeal to the preferences of each individual**

**Changes in the competitive environment**

**Various boundaries that hitherto existed in business are being removed, which will lead to the utilization of digital technology to enter sectors from different industries and the flourishing of cross-border business**

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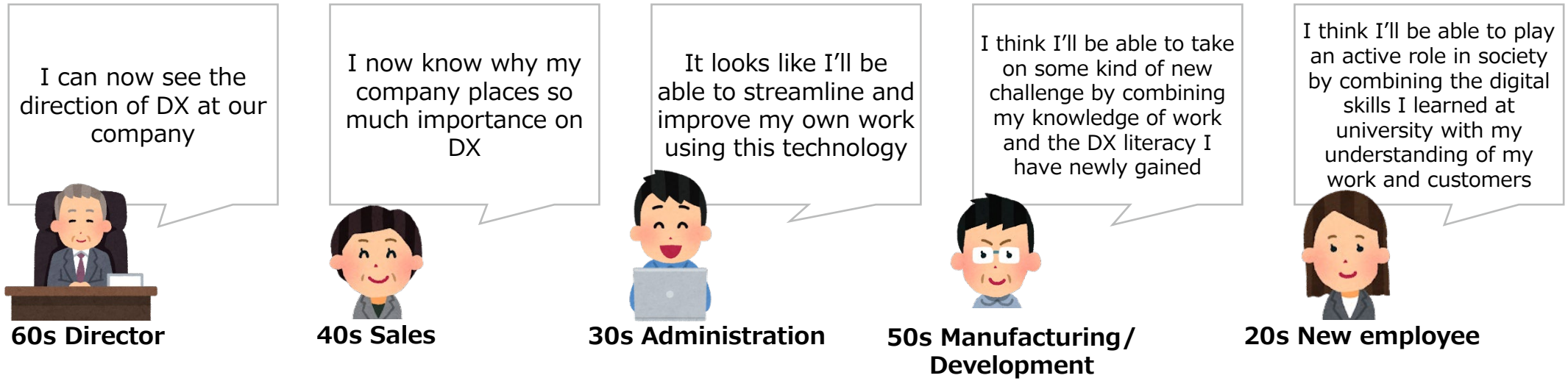
# The Aim of the DSS-L

## The Aim of the DSS-L

Enabling action toward transformation through each and every business person acquiring DX literacy and treating DX as their own work

## Examples of human resources who have gained DX literacy




- ✓ DX is accelerating across society as a whole, mainly at organizations or companies, in order to respond to changes in the social environment and business environment.
- ✓ Against this backdrop, it is important for each and every business person to take it upon themselves to keep learning, regardless of their organization, generation, or job type, in order to survive in the age of the 100-year life.
- ✓ The DSS-L is a set of learning guidelines that lays out the mindset and stance, knowledge and skills required for each and every business person to participate in DX and make use of the results of DX in their work and daily life.

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# Effects of Study in Line with the DSS-L (Individuals)

- ✓ Study in line with the DSS-L will enable individuals to tune their antennae into the latest technologies and DX currently underway in society. By tuning their own antennae in this way, individuals will be able not only to acquire a knowledge of the content of the DSS-L, but also to develop an interest in related new topics and keywords that are emerging every day.
- ✓ Individuals will need a willingness to use the content of the DSS-L as a starting point, and to investigate for themselves the content and meanings of new technologies and words (including what are termed “buzzwords”) that are being created every day.

**Scope of the DSS-L’s focus**

**Learn/investigate** → **Try to use** → **Utilize**

- ✓ Can learn about the necessity of DX, along with data and digital technology, in line with the DSS-L, and can **tune their antennae for DX to include content not covered in the DSS-L**
- ✓ Regardless of whether or not a topic is covered in the DSS-L, can expand their knowledge to encompass DX **by investigating for themselves any unfamiliar words they encounter**

- ✓ Actually encounters accessible technologies/tools

- ✓ Thinks about ways to utilize them in their own work and then put them into practice

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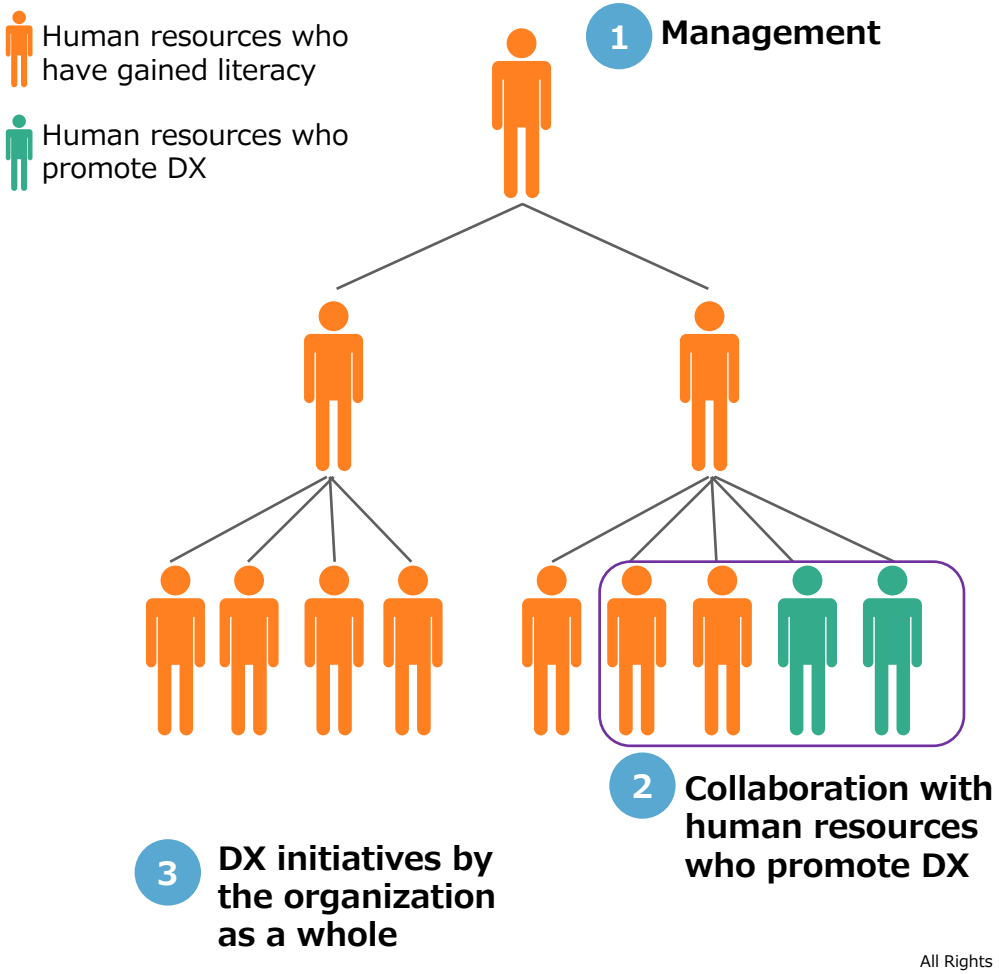
# Effects of Study in Line with the DSS-L (Organizations/Companies)

✓ By increasing the number of human resources who have gained DX literacy and have their antennae tuned into DX, organizations/companies will be able to speed up DX.




1 By finding out about technologies and approaches that are useful in addressing social change and changes in the business environment, **management will be able to consider the direction their company should take in DX and present their vision to their employees.**

2 **Human resources who have a knowledge of the content of the business itself and the work involved** will gain literacy and tune their antennae into DX. This will assist in the discovery of DX possibilities within the organization/company and facilitate cooperation with human resources who have a high level of DX-related expertise (human resources who promote DX), **thereby promoting DX for the company as a whole.**

3 **Human resources in assorted organizations who are of various ages, ranks and job types** will gain DX literacy, which will **increase their receptivity to the changes that will occur within the organization as a result of DX promotion** by the organization/company.

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# Chapter 2

# Structure of the DSS-L

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# Overview of the DSS-L

## Aims of the Establishment of the Standards

Enabling action toward transformation through each and every business person acquiring DX literacy and treating DX as their own work

### Why
Background to DX

- ✓ Define the knowledge concerning society, customers and users, and changes in the competitive environment required to understand the importance of DX

→ Use as learning guidelines for knowledge to be acquired as DX literacy

### What
Data and technology used in DX

- ✓ Define knowledge concerning data and digital technology used in business

→Use as learning guidelines for knowledge to be acquired as DX literacy

### How
Use of data and technology

- ✓ Define knowledge concerning how to use data and digital technology in business, usage examples, and points for attention

→ Use as learning guidelines for knowledge to be acquired as DX literacy

## Mindset and Stance

- ✓ Define the mindset, approach and actions required to produce new value against the backdrop of social change

→Guidelines for individuals to reflect on their own actions, and guidelines for an organization or company to consider the mindset, approach and actions required of the people who constitute it in order to promote DX and achieve continuous growth

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# List of Items

## The Aim of the DSS-L

Enabling action toward transformation through each and every business person acquiring DX literacy and treating DX as their own work

### Why Background to DX

- Change in society
- Changes in customer value
- Changes in the competitive environment

### What Data and technology used in DX

| | |
|---|---|
| Data | Data in society |
| | Reading and explaining data |
| | Handling data |
| | Making judgments based on data |
| Digital technology | AI |
| | Cloud |
| | Hardware/software |
| | Networks |

### How Use of data and technology

| | |
|---|---|
| Example uses/ usage method | Example uses of data and digital technology |
| | Use of tools |
| Points for attention | Security |
| | Moral issues |
| | Compliance |

## Mindset and Stance

| | | | | |
|---|---|---|---|---|
| Design thinking/agile working style | Empathy with customers and users | Out-of-the-box thinking | Iterative approach | |
| Mindset and stance as the foundation for producing new value | Adapting to change | Collaboration | Flexible decision making | Decisions based on facts |

Will keep up with changes in the form DX takes going forward, and make the necessary revisions.

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# Revision of the Digital Skill Standards <Summary> (August 2023)

- Rapidly spreading generative artificial intelligence (AI) is expected to accelerate the advancement of digital transformation (DX) in companies, and it has the potential to increase companies' competitiveness. At the same time, the skills and literacy required of business people are expected to change, and some aspects of the skills are assumed to become more important than before. In order to respond to this situation, necessary revisions were made to the DSS-L, one of the two sets of standards that constitute the Digital Skill Standards formulated at the end of last year.

## Aims of the Establishment of the Standards

**No revision**

### Why
(Background to DX)

- ✓ **Learning subject examples related to human resource development/education and changes in the labor market, etc. were added** to **"Changes in society,"** as generative AI is increasingly used in industry, government and academia and has the potential to affect the social environment.

### What
(Data and technology used in DX)

- ✓ **Learning subject examples related to AI ethics and technical trends of generative AI, etc. were added** to **"AI,"** as generative AI is rapidly spreading and being used in business.
- ✓ **Learning subject examples related to network types and internet services were added** to **"Networks"** in light of the current status of use of networks.
- ✓ **Contents and learning subject examples related to methods for inputting and maintaining easy-to-use data, etc. were added** to **"Handling data,"** as data handled by individuals and companies, etc. will be used in digital technologies and services.
- ✓ **Contents and learning subject examples related to the importance of making judgments by using appropriate data, etc. were added** to **"Making judgments based on data,"** as results derived from inappropriate data could lead to erroneous judgments and damage.

### How
(Use of data and technology)

- ✓ **Learning subject examples related to usage examples of generative AI were added** to **"Example uses of data and digital technology"** and **those related to the outlines and prompting methods, etc. of generative AI tools were added** to **"Use of tools,"** as generative AI can be used in various work scenes by using knowledge of tools, etc. and prompting methods.
- ✓ **Learning subject examples related to the risks, etc. involved in data leakage were added** to **"Moral issues"** and **those related to laws and regulations and terms of use, etc. were added** to **"Compliance,"** as users are required to use generative AI while properly dealing with information leakage, laws and regulations, terms of use, etc.

## Mindset and Stance

- ✓ As the items in this section **define more universal elements** than items in other sections, they will **also be important in using generative AI.**
- ✓ **The importance of appropriate data input and action examples, etc. were added** to **"Decisions based on facts"** as decisions based on facts will only be valid through the use of appropriate data.
- ✓ As it will become increasingly important in the future for all business people to have a mindset and stance **to appropriately use generative AI for productivity improvement or business transformation, etc. by combining it with the skills of the business person,** to **understand the points to consider in use of generative AI,** and **to be open to changes and continue to learn about the effects of generative AI,** these elements were **added as "Mindset and stance required in using generative AI" separately from existing items.**

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# Chapter 3

# Skills and Learning Subjects

## a. Overview of Skills and Learning Subjects

## b. Details of Skills and Learning Subjects (Contents, Action Examples and Learning Subject Examples of Each Item)

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# Item Content and Learning Subject Examples - Mindset and Stance

## Goal of learning

To know the mindset and stance required to produce new value against the backdrop of social change and have the ability to reflect on their own actions

| Item | Content | Learning subject examples |
|---|---|---|
| **Adapting to change** | ✓ Accepts changes in the environment, work and working style, and undertakes self-directed study to adapt to them<br>✓ Equips themselves with new values, behaviors, knowledge and skills in response to environmental changes, while remaining aware of elements of their existing values or those of their organization that should be respected | ✓ Examples of specific behaviors or effects that the individual should aim to demonstrate in the environment in which they have been placed<br>etc. |
| **Collaboration** | ✓ Respects diversity and understands the importance of collaboration with people both within the company and outside it who have a variety of expertise, for the purpose of value creation | |
| **Empathy with customers and users** | ✓ Centers customers and users, and seeks to discover needs and challenges from the perspective of the customer/user | |
| **Out-of-the-box thinking** | ✓ Considers ideas for responding to the needs of and challenges faced by customers and users, without being bound by existing concepts and values<br>✓ Self-questions the reasons for conventional methods of carrying out things and considers any better methods | |
| **Iterative approach** | ✓ Undertakes new initiatives and improvements within a short cycle with a scope that tolerates failure, and makes iterative improvements after gaining customer/user feedback<br>✓ Makes course corrections as needed in the event of failure, and is aware that having learned lessons from failure also constitutes a positive outcome | |
| **Flexible decision making** | ✓ If necessary for the purpose of value creation, makes decisions adapted to the situation, even in situations where judgments on the basis of existing values are difficult | |
| **Decisions based on facts** | ✓ Looks at things and makes decisions on the basis of not only instinct and experience, but also objective facts and data<br>✓ Understands that decisions based on facts and data are only valid when appropriate data is used, and makes a conscious effort to enter appropriate data | |

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# Mindset and Stance Required in the Use of Generative AI (added in the August 2023 revision)

- ✓Seeks to put generative AI to appropriate use in the improvement of productivity and business transformation by combining it with skills required as a business person, such as “asking questions” and “formulating and verifying a hypothesis”
- ✓In using generative AI, understands that the output may contain unexpected results and caution is required in regard to the infringement of copyright and other rights, information leakage and ethical issues, among others
- ✓Willingly continues to learn about changes while keeping their antennae tuned in to the impacts on lifestyles and business of the emergence and spread of generative AI, and to changes in familiar settings in the near future

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# Item Content and Learning Subject Examples - Why

## Goal of learning

To know how the values people regard as important and the socioeconomic environment are changing, and to understand the importance of DX

| Item | Content | Learning subject examples |
|---|---|---|
| **Change in society** | ✓ Understands the changes that are occurring around the world and in Japanese society, and knows that the utilization of data and digital technology is useful in order to improve people's lives amid change and to solve social challenges | ✓ Megatrends/social challenges and their solution using digital technology (SDGs, etc.)<br>✓ Differences between Japan and other countries in terms of DX initiatives<br>✓ Keywords related to social and industrial change (Society 5.0, data-driven society, etc.)<br>etc. |
| **Changes in customer value** | ✓ Understands the concept of customer value and knows how customers/users have changed as a result of advances in digital technology (diversification of access to information, products and services, and increased desire to fulfill individuals' varying needs) | ✓ Behavioral change among customers/users and responses to change<br>✓ Digital services surrounding customers/users<br>etc. |
| **Changes in the competitive environment** | ✓ Knows that, as a result of advances in data/digital technology and changes in society/customers, the sources of the competitiveness of existing business are changing, and that business is spreading beyond national borders and conventional industry boundaries | ✓ Specific examples of changes in the competitive environment resulting from the utilization of digital technology<br>etc. |

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# Item Content and Learning Subject Examples - What (1/2)

## Goal of learning

To be able to gain deeper knowledge of the background to advances in data and digital technology as a means of DX promotion after finding out the latest information about them

| Item | Content | Learning subject examples |
|---|---|---|
| **Data**<br>**Data in society** | ✓ Knows that there are various types of data, including not only numbers, but also characters, images and sound, and knows how to store such data and utilize it in society | ✓ Types of data<br>✓ Utilization of data in society<br>etc. |
| **Data**<br>**Reading and explaining data** | ✓ Understands data analysis techniques and how to read the results<br>✓ Comprehends the meaning of data analysis results and understands ways of explaining them appropriately that are tailored to the purpose of the analysis and the recipients of the explanation | ✓ Data analysis techniques (basic knowledge of probability and statistics)<br>✓ Reading of data (methods of comparison, overlap, etc.)<br>✓ Explanation of data (visualization, verbalization of analysis results)<br>etc. |
| **Data**<br>**Handling data** | ✓ Understands data entry and maintenance techniques that are easy to utilize with digital technology and services<br>✓ Understands that the use of data involves situations in which various data extraction and processing techniques, and technology such as databases are essential | ✓ Data entry<br>✓ Data extraction and processing (cleansing, aggregation, etc.)<br>✓ Data output<br>✓ Databases (database types, structures, etc.)<br>etc. |
| **Data**<br>**Making judgments based on data** | ✓ Understands the structures of operations/businesses and the purpose of analysis, and knows about approaches to data analysis and use<br>✓ Understands that even if the analysis provides results that differ from the expected results, this in itself is an important finding<br>✓ Understands techniques for identifying actions for the improvement of management and work from analysis results, and techniques for monitoring what results these actions have had<br>✓ Understands that decisions based on data are only valid when appropriate data is used | ✓ Data-driven decision making process<br>✓ Analysis approach design<br>✓ Monitoring techniques<br>etc. |

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# Item Content and Learning Subject Examples - What (2/2)

## Goal of learning

To be able to gain deeper knowledge of the background to advances in data and digital technology as a means of DX promotion after finding out the latest information about them

| Item | Content | Learning subject examples |
|---|---|---|
| **Digital technology**<br>**AI** | ✓ Knows the background to the creation of AI and the reasons why it has spread rapidly<br>✓ Understands the mechanisms of AI and knows what AI can and cannot do<br>✓ Understands the possibilities for utilizing AI and knows tips for increasing its precision<br>✓ Knows about trends in AI models commonly used in organizations/society | ✓ The history of AI<br>✓ Techniques and technologies for creating AI<br>✓ The fields of strength and limitations of AI<br>✓ Social principles of human-centric AI, ELSI<br>✓ Latest technology trends (generative AI, etc.)<br>etc. |
| **Digital technology**<br>**Cloud** | ✓ Understands cloud mechanisms and knows the difference between cloud and on-premise<br>✓ Knows about cloud service delivery models | ✓ Cloud mechanisms (ways of holding data, data protection mechanisms)<br>✓ Cloud service delivery models (SaaS, IaaS, PaaS, etc.)<br>✓ Latest technology trends<br>etc. |
| **Digital technology**<br>**Hardware/software** | ✓ Knows the mechanisms by which devices such as computers and smartphones operate<br>✓ Knows how the company's internal systems and the like are made | ✓ Hardware (constituent elements of hardware, computer types)<br>✓ Software (software types, programming thinking)<br>✓ Development and operation within companies<br>✓ Latest technology trends<br>etc. |
| **Digital technology**<br>**Networks** | ✓ Knows the basic mechanisms involved in networks<br>✓ Knows the mechanisms of the internet and major internet services | ✓ Network mechanisms (LAN/WAN, communications protocols)<br>✓ Internet services (e-mail)<br>✓ Latest technology trends<br>etc. |

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# Item Content and Learning Subject Examples - How

## Goal of learning

To understand example uses of data and digital technology and learn how to use the basic tools for their utilization, and then to be able to actually use them in work, while also taking into account points for attention and the like

| Item | Content | Learning subject examples |
|---|---|---|
| **Example uses/usage methods**<br>**Example uses of data and digital technology** | ✓ Knows example uses of data and digital technology in business<br>✓ Understands that data and digital technology can be used in various work and can imagine situations in which they can be applied to their own work | ✓ Example uses of data and digital technology in business activities<br>✓ Examples of generative AI use<br>etc. |
| **Example uses/usage methods**<br>**Use of tools** | ✓ Has a knowledge of ways to use tools and can select the appropriate tool for the situation in everyday work | ✓ Ways to use tools relevant to everyday work<br>✓ Ways to use generative AI (prompt techniques, etc.)<br>✓ Ways to use digital tools relevant to automation and streamlining<br>etc. |
| **Points for attention**<br>**Security** | ✓ Has a knowledge of the mechanisms of security technologies and measures that individuals should take, and can use data and digital technology with peace of mind | ✓ The three elements of security<br>✓ Security technology<br>✓ Security measures that individuals should take<br>etc. |
| **Points for attention**<br>**Moral issues** | ✓ Has the sense of morality required in an age in which individuals can freely exchange information on the internet, and can communicate appropriately on the internet<br>✓ Knows about things that are prohibited in data analysis, such as fabrication, falsification, and plagiarism, and can use data appropriately<br>✓ Can imagine the hazards and impacts of data leakage | ✓ Examples of problems related to such matters as online harm, social media and generative AI, and measures to combat them<br>✓ Points for attention and things that are prohibited in the use of data<br>etc. |
| **Points for attention**<br>**Compliance** | ✓ Knows about privacy, intellectual property rights and copyright, along with laws for their protection and data regulations in other countries<br>✓ When using data or technology in their actual work, can check that there are no problems with their work in light of laws, regulations and terms of use | ✓ Definitions of personal information and laws related to personal information, along with points for attention regarding these<br>✓ The focus of protection under copyright, industrial property rights and other rights<br>✓ Data regulations in other countries<br>✓ Scope of data use in light of terms of use for services<br>etc. |

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# DSS-L Usage Examples - Supplementary Information (The Difference between What and How)

In the DSS-L, “What” and “How” are categorized from the perspective of the level at which the individual can use their knowledge and skills in actual work—that is to say, whether or not they can be asked to put their knowledge and skills into practice

| What | How |
| --- | --- |
| • Knowledge that individuals should have, regardless of whether or not they utilize it in their work, including items that may not actually be directly necessary when business people who undertake study in line with the DSS-L actually perform their work<br>✓ Knowledge required to understand what kind of knowledge human resources who promote DX actually bring to their work and to facilitate collaboration by those human resources<br>✓ Knowledge required to better understand articles and books about DX in the world around them | • Items that constitute knowledge and skills for use in their work that it is desirable for business people who undertake study in line with the DSS-L to use when they actually carry out tasks and make judgments in their work<br>✓ Knowledge required for the selection of appropriate tools in their work and for use in such situations as making operational improvements (Example Uses / Use of Tools)<br>✓ Knowledge of which individuals must be aware when actually using tools and data (Security / Moral Issues / Compliance) |

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# Chapter 3

# Skills and Learning Subjects

## a. Overview of Skills and Learning Subjects

## b. Details of Skills and Learning Subjects (Contents, Action Examples and Learning Subject Examples of Each Item)

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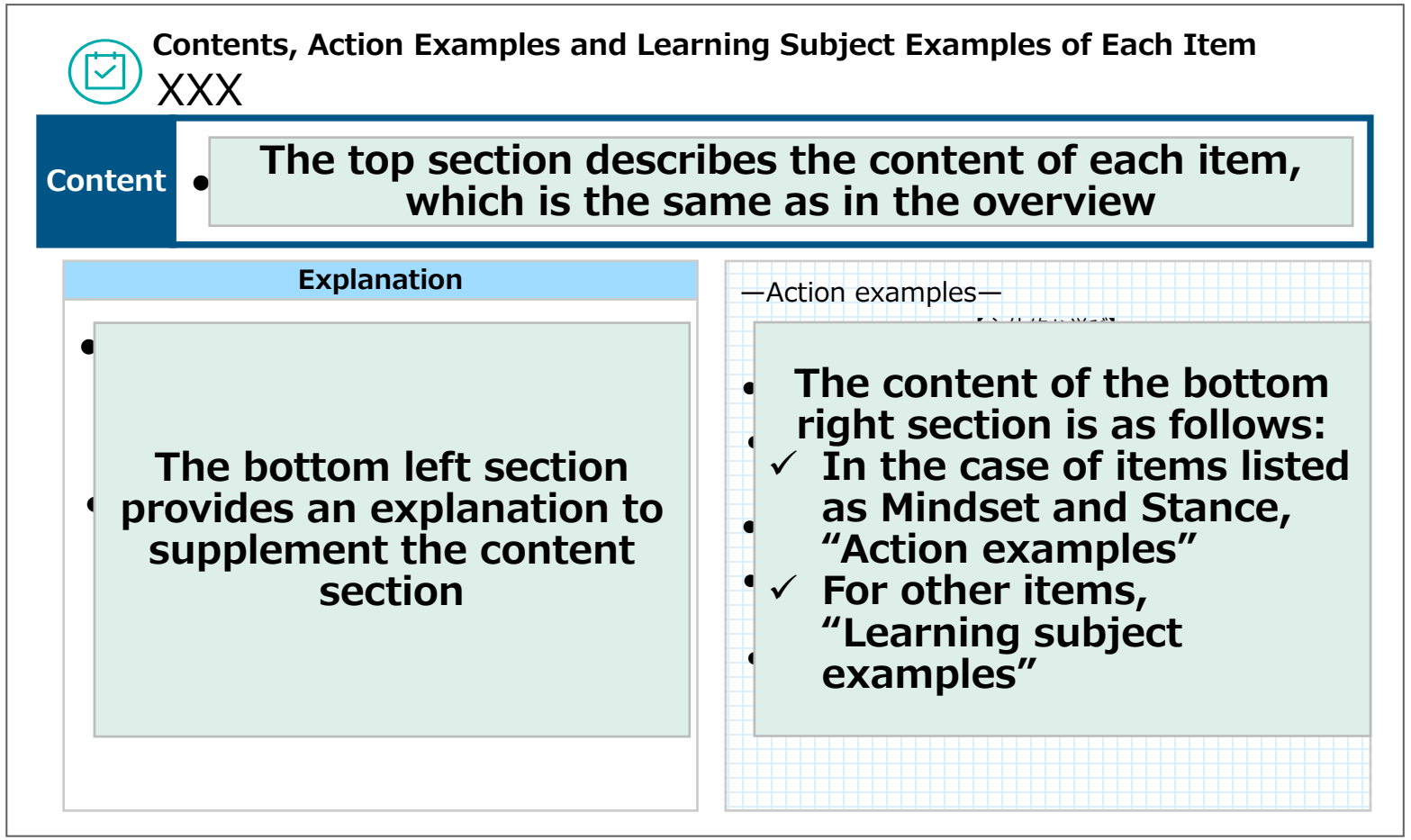
# Contents, Action Examples and Learning Subject Examples of Each Item

The pages that follow describe the content of each item in the DSS-L and also explain each one.

**Illustration of descriptions in the pages that follow**

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# Mindset and Stance - Adapting to Change

**Content**

- Accepts changes in the environment, work and working style, and undertakes self-directed study to adapt to them
- Equips themselves with new values, behaviors, knowledge and skills in response to environmental changes, while remaining aware of elements of their existing values or those of their organization that should be respected

## Explanation

- To adapt to social or industrial changes that form the background to DX, or to changes in organizations or approaches to work that arise from DX, for example, business people need not only to undergo training provided by the organization to which they belong, but also to actively take steps to acquire new knowledge.
- Amid social and industrial changes, it is necessary for business people to reflect on the knowledge and skills that they have acquired and the empirical rules that they have cultivated through their experience to date as working members of society, to ensure that these are not outdated, in order to execute their work and make decisions in a manner adapted to those changes.

## —Action examples—

[Self-directed study]

- Employees read books and newspaper articles about emerging technologies
- Employees use e-learning services to which they can subscribe as individuals to gain knowledge about their work and sector
- Employees voluntarily participate in workshops relevant to the industry in which their company operates or to the business segment in which they are involved

[Acquisition of new values, behaviors, knowledge and skills]

- Employees had been managing data on their own desktop, but after being provided with a cloud-based tool that allows real-time co-authoring, identified data that should be subject to real-time co-authoring in the cloud and transferred that data to the cloud
- Employees had been exchanging information by e-mail and included the requisite individuals in the cc line when sharing it, but subsequently created a group on a communication tool so that the information was gathered together for the group

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# Mindset and Stance - Collaboration

**Content**

- Respects diversity and understands the importance of collaboration with people both within the company and outside it who have a variety of expertise, for the purpose of value creation

## Explanation

- To step up the pace of DX, business people with a variety of expertise must pool their wisdom and think about the situation they want to achieve and ways of bringing it to fruition. To this end, business people need to proactively collaborate with individuals who have diverse perspectives and areas of expertise, including individuals beyond the organization/company to which they belong.
- At a time when it is envisaged that, due to the utilization of digital technology, members of organizations/companies will increasingly work at different times and in different locations from each other, business people must respect each and every individual's working style, regardless of sex or nationality.

## —Action examples—

[Collaboration with people who have a variety of expertise]

- When working on solving a problem in their own department, employees discovered that the content also appeared to be relevant to other departments and therefore established a cross-divisional team
- Employees collaborated with specialist external human resources outside the company to promote a project they had set up, because there were no human resources with a high level of expertise relevant to the project within the company

[Respect for diversity]

- After being assigned to participate in a team that included many members with expertise that differed from their own, due to an internal measure instituted by the company, employees expressed their views from the perspective of their own expertise in language that was easily understood even by those who did not have that specialist knowledge
- As a team member was only able to work during specific hours, due to providing nursing care for a family member, employees divided up roles in a way that took into account the hours the individual could work and their expertise
- As a team member from another country did not speak Japanese as their native language, employees communicated in Japanese that was as simple as possible and also incorporated communication in English, which was a language they all had in common

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# Mindset and Stance - Empathy with Customers and Users

**Content**

- Centers customers and users, and seeks to discover needs and challenges from the perspective of the customer/user

## Explanation

- To carry out the transformation of service models and products referred to in the definition of DX, business people must perceive needs and challenges from the perspective of the customer/user, including being aware that problems and needs include not only those that are visibly apparent and those that are currently a problem, but also dreams and aspirations for things that would be nice to have.
- Business people can drive improvements in internal operations if they recognize that customers and users include not only users of the company's products and services, but also users such as those who use the company's internal services and one's own next process.

## —Action examples—

[Discovery of needs and challenges from the perspective of the customer/user]

- Employees identified unverbalized needs by analyzing not only information submitted as user feedback, but also user actions before and after the feedback
- Employees worked to improve the quality of products and services, while regarding not only direct users, but also partner companies (agents, suppliers, outsourced service providers, etc.) as users

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# Mindset and Stance - Out-of-the-Box Thinking

**Content**

- Considers ideas for responding to the needs of and challenges faced by customers and users, without being bound by existing concepts and values
- Self-questions the reasons for conventional methods of carrying out things and considers any better methods

## Explanation

- Since various tools related to data and digital technology are constantly emerging as means of DX, a business person needs to not only make improvements based on conventional methods, but also consider methods that completely differ from conventional methods.
- If business people have an attitude to self-question the reasons and background for carrying out their work or services by conventional methods, even if not from the perspective of customers and users, they can discover parts that may or should be changed in their methods.

## —Action examples—

[Consideration of ideas without being bound by existing concepts and values]

- Employees provided in-house training on the company's sales know-how and, thinking that the training contents are also applicable to other companies, took a video of the training and sold it as an e-learning service.

[Review of conventional methods of carrying out things]

- Employees had received customer inquiries at an inquiry desk, but as inquiries could not be received outside office hours, they scaled down the work at the inquiry desk, and developed an easy-to-read manual and a chatbot with which users could search for answers to their inquiries themselves.
- Management-level employees had managed the shifts of workers at a plant, but they introduced an automatic shift scheduling tool and reduced the work of management-level employees.

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# Mindset and Stance - Iterative Approach

**Content**

- Undertakes new initiatives and improvements within a short cycle with a scope that tolerates failure, and makes iterative improvements after gaining customer/user feedback
- Makes course corrections as needed in the event of failure, and is aware that having learned lessons from failure also constitutes a positive outcome

## Explanation

- As there are no precedents that guarantee success when trying an approach that differs from the conventional one, there is a possibility that things might not go well or that the outcome might be something customers/users are not seeking, even if a business person formulates a plan, develops a program or service in line with that plan and carries out operational improvements. Accordingly, business people must undertake development, planning and improvement within a short cycle that tolerates failure, and carry this out while keeping an eye on customer/user reaction.
- Even failure has the potential to provide seeds for the development of a new product or service, or for operational improvements, if a business person makes course corrections as needed, considers the root causes of the failure and learns from it.

## —Action examples—

[Iterative improvement on a short cycle]

- Employees wanted to introduce a management tool, as sales information was managed manually, but given that it constituted a major change from the conventional approach, they decided to first introduce it experimentally at a single branch, then identified which changes were hard for the branch members to deal with and which changes encountered resistance from them, and also clarified measures to address these
- As front line staff proposed the introduction of a tool that did not cost a great deal and that had a short contract cancellation period, employees introduced the tool on a trial basis to see what effects it had
- When the company trialed a new tool, employees noticed that there seemed to be scope for modification and provided feedback to the systems department

[Perception of change as a positive outcome]

- Although the trial implementation of a measure was halted due to having failed to achieve the anticipated effect, employees analyzed the results and discovered the root cause of the failure, so they regarded the failure positively as something that would lead to the next success

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# Mindset and Stance - Flexible Decision Making

**Content**

- If necessary for the purpose of value creation, makes decisions adapted to the situation, even in situations where judgments on the basis of existing values are difficult

## Explanation

- Although a business person might wish to make a judgment on the basis of a precedent when trying to use a different approach from the conventional one, there may not be any examples that can serve as a precedent. In this kind of situation, if a business person decides not to undertake an action due to being unsure of whether it will succeed, it will remain impossible to carry out anything that has no precedent forever, so business people must be willing to make decisions adapted to the situation.

## —Action examples—

[Decision making adapted to the situation]

- Management wanted to provide a new service in response to customer/user feedback, but as it would take time to gain approval on a companywide basis, they began with a trial initiative within a branch office
- Following several rounds of customer interviews, management discovered that there was a need for a service that had no similar precedents within the company. As no similar service had been provided previously, there were no standards within existing internal regulations that could be applied in order to get the go signal to launch the service. However, the service was at least not in breach of the law, so after deciding on the timing of the judgment on whether or not to continue the service and the standards to be used as the basis for this judgment, and instructing the people handling the service to make it clear that it was a beta version, management gave approval to launch the service
- As customer data also included sensitive information, the systems department had previously been asked to extract it, but management conducted a thorough examination of disclosable customer data and put in place a system under which staff in departments other than the systems department could extract disclosable data themselves if they submitted an application that included details of the purpose of use, etc.

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# Mindset and Stance - Decisions Based on Facts

**Content**

- Looks at things and makes decisions on the basis of not only instinct and experience, but also objective facts and data
- Understands that decisions based on facts and data are only valid when appropriate data is used, and makes a conscious effort to enter appropriate data

## Explanation

- Humans have a tendency to make judgments on the basis of their own instinct, experience, or stereotypes, but at a time of dizzying change in the world around us, when a great deal of information and data that differ from the facts are circulating, judgments made on the basis of instinct or experience are not necessarily correct. Accordingly, business people need to look at things and make decisions that do not rely solely on their own instinct and experience, but are also based on objective facts and data.
- In addition, business people must understand that decisions based on facts and data are only valid when appropriate data is used and that entering or saving inappropriate data could invite erroneous judgments, which could result in significant harm. As such, they must be conscious of the importance of entering appropriate data and act accordingly.

## —Action examples—

[Decisions on the basis of objective facts and data]

- When setting sales targets, employees set targets that took into account the market situation and efforts to take on the challenge of discontinuous growth, rather than setting a level at around the same as typical years
- Rather than assuming that the factors contributing to a slump in sales at the same time each year were seasonal, employees analyzed customer data and store sales data to identify them
- When formulating a sales plan, employees identified difficulty in growing sales in Region A, but rather than giving up, they analyzed sales data to identify the root cause of sluggish sales and considered improvement measures
- When formulating a manufacturing plan, employees undertook deliberations that skillfully combined objective facts with experience and instinct cultivated to date
- Employees used output from generative AI after first checking objective facts

[Appropriate data entry]

- When responding to a questionnaire, employees gave responses that matched the questions and submitted the questionnaire by the deadline, rather than leaving it until later and giving haphazard responses
- When handling customer data in the sales management system, employees entered and stored the data while taking care to ensure that the content and quantity were adequate, in line with internal rules. They also did not make any arbitrary revisions to the data

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# Why - Change in Society

**Content**

- Understands the changes that are occurring around the world and in Japanese society, and knows that the utilization of data and digital technology is useful in order to improve people's lives amid change and to solve social challenges

## Explanation

- To understand why DX is necessary in Japanese society, organizations and companies, business people must know about the ways in which society is changing (major trends and social challenges worldwide).
- As disparities between one country and another are being eliminated by factors including technological development and increased mobility of human resources, business people need to know about the status of initiatives in Japan and the initiatives of other advanced countries.
- The growing prevalence of the sharing economy, including bike and car sharing, and various other advances in digital technology are beginning to have an effect on our day-to-day lifestyles, so business people need to have the prerequisite knowledge to use them wisely.

## —Learning subject examples—

- Megatrends/social challenges and their solution using digital technology
  - ✓ Sustainability: SDGs, sustainable development
  - ✓ Economy: Traffic congestion, logistics capacity
  - ✓ Demographics: Population decline, aging of the population
  - ✓ Global environment: Zero-carbon society, climate change, water resources, food supply and demand, measures to combat and address natural disasters and infectious disease
  - ✓ Energy: Sustainability of energy supply
  - ✓ Human resource development and education: Educational disparities, recurrent education and reskilling
  - ✓ Labor markets: Qualitative and quantitative changes in job mobility and the supply and demand of work
- Differences between Japan and other countries in terms of DX initiatives
- Keywords related to social and industrial change
  - ✓ Fourth Industrial Revolution
  - ✓ The society that Society 5.0 will create
  - ✓ Data-driven society

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# Why - Changes in Customer Value

**Content**

- Correctly understands the concept of customer value and knows how customers/users have changed as a result of advances in digital technology (diversification of access to information, products and services, and increased desire to fulfill individuals' varying needs)

## Explanation

- Thanks to the development of digital technology, customers and users (including not only individuals, but also companies) can access various information more easily than in the past. Accordingly, business people must understand that there is a growing appetite for information optimized for the individual, rather than being optimized for as many customers/users as possible.
- At the individual level, amid growing use of services that utilize digital technology (e-commerce, video/music streaming, taxi-hailing apps, delivery services, e-books, etc.), business people must understand that companies need to provide services that utilize digital technology and that their own companies need to utilize existing services as a user, in order to provide new value.

## —Learning subject examples—

- Behavioral change among customers/users and responses to change
  - ✓ Changes in purchasing behavior
  - ✓ Advertising techniques tailored to change: Recommendations, SEO, product listing ads, influencers, OMO (Online Merges with Offline), LBM (Location Based Marketing)
  - ✓ Examples of customer/user behavior analysis that utilize data and digital technology
- Digital services surrounding customers/users
  - ✓ E-commerce
  - ✓ Video/music streaming
  - ✓ Taxi-hailing apps
  - ✓ Delivery services
  - ✓ E-books
  - ✓ Internet banking

  etc.

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# Why - Changes in the Competitive Environment

**Content**

- Knows that, as a result of advances in data/digital technology and changes in society/customers, the sources of the competitiveness of existing business are changing, and that business is spreading beyond national borders and conventional industry boundaries

## Explanation

- To enable their own company to continue to grow amid changes in society and customers, business people need to know that advances in digital technology have substantially lowered the barriers to new entrants compared with the past, and that it is easier to buy and sell products and services across borders. Accordingly, business people must understand how their company's competitive environment has changed as a result, compared with the past, or how it could potentially change.

## —Learning subject examples—

- Specific examples of changes in the competitive environment resulting from the utilization of digital technology
  - ✓ Environmental changes in the publishing and book distribution industry (increase in the share of electronic media, availability of information on the internet)
  - ✓ Environmental changes in the market for buying and selling rare and secondhand books (emergence of CtoC platforms)
  - ✓ Environmental changes in the rental video and CD shop market (emergence of video and music streaming services)
  - ✓ Environmental changes in the travel industry (travel agents) (emergence of services that enable individuals to easily make their own reservations for accommodation and tours, both within Japan and overseas)
  - ✓ Environmental changes in music streaming services (shift from purchasing individual songs or albums to subscription-based services)

(Source) Ministry of Internal Affairs and Communications, Information and Communications in Japan White Paper 2021

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# What - Data in Society

**Content**

- Understands that there are various types of data, including not only numbers, but also characters, images and sound, and knows how to store such data and utilize it in society

## Explanation

- As the utilization of big data progresses, business people need to understand that data can include not only data on the operational status of machinery and the like, but also characters, sound, video and even their own activity history.
- Rather than fearing big data and treating the unfamiliar with suspicion, business people must know how big data is used in order to make use of it in a convenient manner.

## —Learning subject examples—

- Types of data
  - ✓ Classification by acquisition method: Activity log data, machinery operation log data, experimental data, survey data, biometric data
  - ✓ Classification by agent of acquisition: Primary data, secondary data
  - ✓ Classification by the data's own attributes: Structured data, unstructured data (characters, images and sound, etc.), metadata
- Utilization of data in society
  - ✓ Big data and annotation
  - ✓ Open data

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# What - Reading and Explaining Data

**Content**

- Understands data analysis techniques and how to read the results
- Comprehends the meaning of data analysis results and understands ways of explaining them appropriately that are tailored to the purpose of the analysis and the recipients of the explanation

## Explanation

- To make management/work decisions on the basis of facts obtained from data, business people need to acquire the basic knowledge of probability and statistics required to read data, along with a knowledge of methods for comparing pieces of data.
- To use hints gained from the reading of data for decision making as an organization, business people need to know techniques for the visualization of results.

## —Learning subject examples—

- Data analysis techniques (basic knowledge of probability and statistics)
  - ✓ Qualitative variables and quantitative variables
  - ✓ Data distribution (histograms) and averages (mean, median and mode)
  - ✓ Data variation (variance, standard deviation, deviation values)
  - ✓ Correlation and causation
  - ✓ Data types (nominal scale, ordinal scale, interval scale, ratio scale)
- Reading data
  - ✓ Noticing duplication in data or phenomena
  - ✓ Comparisons that satisfy the conditions
  - ✓ Spotting exaggeration
  - ✓ Identification of errors in tabulation or description
- Explanation of data
  - ✓ Visualization of data (preparation of bar charts, line graphs, scatter diagrams, heat maps, etc.)
  - ✓ Verbalization of the results of analysis

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# What - Handling Data

**Content**

- Understands data entry and maintenance techniques that are easy to utilize with digital technology and services
- Understands that the use of data involves situations in which various data extraction and processing techniques, and technology such as databases are essential

## Explanation

- Going forward, there is a possibility that data handled in a business person's own work or by their department could be utilized in numerous digital technologies and services (e.g. AI training data input). Accordingly, business people must know data entry and maintenance techniques that make the data not only easy for humans to understand, but also readily utilized in digital technology and services.
- To gain a deeper understanding of data use, business people need to know techniques related to data extraction, processing and output.
- To gain a deeper understanding of data use, business people need to know mechanisms related to databases, which are a form of technology essential to data use.

—Learning subject examples—

- Data entry
  - ✓ Machine-readable data preparation and notation methods (Reference: Ministry of Internal Affairs and Communications, Uniform Rules on Machine-Readable Data Notation Methods)
- Data extraction and processing
  - ✓ Data extraction, data cleansing (outliers and abnormal values), filtering and sorting, joining, mapping, sampling, aggregation/conversion/computation
- Data output
  - ✓ Downloading and saving data, file formats
- Databases
  - ✓ Database management systems
  - ✓ Database types: Relational databases, key-value format
  - ✓ Database structures: Tables, records, fields
  - ✓ Database design: Overview of data normalization, ER diagrams

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# What - Making Judgments Based on Data

**Content**

- Understands the structures of operations/businesses and the purpose of analysis, and knows about approaches to data analysis and use
- Understands that even if the analysis provides results that differ from the expected results, this in itself is an important finding
- Understands techniques for identifying actions for the improvement of management and work from analysis results, and techniques for monitoring what results these actions have had
- Understands that decisions based on data are only valid when appropriate data is used

## Explanation

- Business people need to know the importance of the formulation of a hypothesis concerning the purpose for which the data will be used and what results are forecast to be obtained, as a prerequisite for handling data.
- Results generated from inappropriate data can invite erroneous judgments and, as a result, lead to significant harm. Accordingly, business people must know that, when making judgments on the basis of data, it is vital to use appropriate data that satisfies both qualitative and quantitative requirements.
- Business people need to know techniques for designing analytical approaches for the achievement of the objectives of the analysis and also for designing medium- to long-term monitoring methods.

## —Learning subject examples—

- Data-driven decision making process
  - ✓ Hypothesis formulation
  - ✓ Revision of a hypothesis
  - ✓ Verification of data using primary information
  - ✓ Determination and disclosure of data integrity (e.g. checking that the content has no errors or bias, that there is an adequate volume of data, that the source and date of last modification are clear, and that the data has been handled on the basis of the organization’s rules)
  - ✓ Decision making on the basis of the results of analysis
- Analysis approach design
  - ✓ Securing the requisite data
  - ✓ Structural understanding of the analysis subject
  - ✓ Business analysis techniques
  - ✓ Design of data, analysis techniques and visualization methods
- Monitoring techniques

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# What - AI

**Content**

- Knows the background to the creation of AI and the reasons why it has spread rapidly
- Understands the mechanisms of AI and knows what AI can and cannot do
- Understands the possibilities for utilizing AI and knows tips for increasing its precision
- Knows about trends in AI models commonly used in organizations/society

## Explanation

- As AI is affecting our daily lives, due to the spread of generative AI and wearable devices, among others, business people need to understand why such changes have occurred.
- As it is envisaged that the future will bring situations in which AI is also used at work, business people need to know what AI can and cannot do.
- To gain a more concrete impression of what AI can do, business people must know how AI processes things.
- Business people need to regularly obtain updated information about AI that is attracting interest in the world around them.

## —Learning subject examples—

- The history of AI
  - ✓ The definition of AI
  - ✓ Transitions in the AI boom
  - ✓ Studies and technologies at the heart of past AI booms (searches, inference, etc.)
- Techniques and technologies required to create AI
  - ✓ Specific machine learning techniques: Supervised learning, unsupervised learning, reinforcement learning, etc.
  - ✓ Overview of deep learning: Neural networks, pretraining, fine-tuning, large language models, foundation models, etc.
  - ✓ Approaches to undertaking AI projects, etc.
- Social principles of human-centric AI, ELSI (Ethical, Legal and Social Issues), etc.
- The fields of strength and limitations of AI
  - ✓ Strong AI and weak AI, etc.
- Latest AI-related technology trends
  - ✓ Generative AI, etc.

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# What - Cloud

**Content**

- Understands cloud mechanisms and knows the difference between cloud and on-premise
- Knows about cloud service delivery models

## Explanation

- As the cloud is a technology used in many services that utilize data and AI that have become mainstream in recent years, business people need to learn how data is held in the cloud.
- As the number of business system services provided in cloud form is also on the rise, business people must know the mechanisms that make the cloud's safe use possible, to ensure they do not harbor excessive anxieties about the cloud.
- As services that use the cloud are becoming widespread not only in the field of business systems, but also in services used in daily life, business people must know which services use cloud technology.

## —Learning subject examples—

- Cloud mechanisms
  - ✓ The difference between on-premise and cloud
  - ✓ Public cloud and private cloud
  - ✓ Security measures in cloud services
- Cloud service delivery models
  - ✓ SaaS (Software as a Service)
  - ✓ IaaS (Infrastructure as a Service)
  - ✓ PaaS (Platform as a Service)
- Latest cloud-related technology trends

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# What - Hardware and Software

**Content**

- Knows the mechanisms by which devices such as computers and smartphones operate
- Knows how the company's internal systems and the like are made

## Explanation

- As the number of types of devices with computing functions is increasing, business people must know what types of devices are used as computers.
- To use computers in daily life and work, business people must know the fundamental mechanisms by which computers work and the software mechanisms that make them function.
- Business people must understand what the systems used in their work can and cannot do, and, in order to facilitate communication with departments in charge of development, must know about ways of thinking when giving instructions to computers and what kind of work IT departments and the like carry out.

## —Learning subject examples—

- Hardware
  - ✓ Hardware components: Processor, memory, storage, input-output devices
  - ✓ Types of computers and input-output devices: PCs, servers, general purpose machines, smartphones, tablets, wearable devices, smart speakers, sensors, digital signage, drones
- Software
  - ✓ Software components: OS, middleware, applications
  - ✓ Open source software
  - ✓ Programming thinking: Basic concepts of algorithms, features of programming languages
- Development and operation within companies
  - ✓ Overview of project management
  - ✓ Overview of service management
- Latest technology trends related to hardware and software

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# What - Networks

**Content**

- Knows the basic mechanisms involved in networks
- Knows the mechanisms of the internet and major internet services

## Explanation

- When using the internet and the like, business people need to have basic knowledge about network mechanisms and the mechanisms that support internet technology.
- Knowing the types of internet technology that they will frequently encounter in daily life will enable business people to use them effectively.

## —Learning subject examples—

- Network and internet mechanisms
  - ✓ Network systems (LAN, WAN)
  - ✓ Connection devices (hubs and routers)
  - ✓ Communications protocols
  - ✓ IP addresses
  - ✓ Domains
  - ✓ Wireless communications (Wi-Fi, etc.)

  etc.
- Internet services
  - ✓ E-mail
  - ✓ 5G (mobile)
  - ✓ Remote conferencing and other communication services
  - ✓ Online payment and other financial services

  etc.
- Latest network-related technology trends

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# How - Example Uses of Data and Digital Technology

**Content**

- Knows example uses of data and digital technology in business
- Understands that data and digital technology can be used in various work and can imagine situations in which they can be applied to their own work

## Explanation

- To develop the ability to imagine how they can use data and digital technology in their own work and in the services they handle, business people must know that data and digital technology are utilized in a variety of business settings and must come into contact with specific examples.

## —Learning subject examples—

- Example uses of data and digital technology in business activities
  - ✓ Services: Introduction of robot waiters, analysis of purchasing trends using customer information
  - ✓ Sales: Virtual try-on services, unstaffed convenience stores
  - ✓ Marketing: Recommendation functions tailored to purchasing history, product listing ads that use big data
  - ✓ Manufacturing: Storage and analysis of manufacturing data (smart factories), automated management and procurement of parts inventory
  - ✓ Research and development: Switch to remote research work, construction of research data infrastructure systems
  - ✓ Procurement: Introduction of electronic contract systems, centralization of supply chain information
  - ✓ Logistics: Blockchain-based production information tracking, prevention of redelivery by using customer information
- Example uses of generative AI
  - ✓ Use of large language models in such tasks as the preparation and summary of texts, the collection of information, the identification of challenges, and brainstorming for all kinds of work
  - ✓ Improvement of customer experience, business transformation, etc.

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# How - Use of Tools

**Content**

- Has a knowledge of ways to use tools and can select the appropriate tool for the situation in everyday work

## Explanation

- In both day-to-day work and DX initiatives conducted within organizations, business people need to know about ways to use various tools and generative AI, in order to select and use the appropriate tool for the situation.
- Business people must gain a basic knowledge even of digital tools that are not frequently used in routine work, so that they can consider the introduction of appropriate tools according to the situation.

## —Learning subject examples—

- Ways to use tools relevant to everyday work
  - ✓ Communication tools: E-mail, chat, project management
  - ✓ Office tools: Alteration of character size and font, basic functions, creation of tables, handy shortcuts
  - ✓ Search engines: Search tips
- Ways to use generative AI
  - ✓ Overview of image generation tools, text generation tools and speech production tools
  - ✓ Prompt techniques
- Ways to use digital tools relevant to automation and streamlining
  - ✓ Basic knowledge about no-code/low-code tools
  - ✓ Overview of tools for automation and in-house development of RPA, AutoML, etc.

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# How - Security

**Content**

- Has a knowledge of the mechanisms of security technologies and measures that individuals should take, and can use data and digital technology with peace of mind

## Explanation

- Rather than feeling pointless anxiety about data and digital technology, business people need to know about the mechanisms that protect information, in order to use them appropriately.
- Business people must understand not only the environments and measures provided by their companies, but also the need for individuals to take security measures and ways in which they can do so.

## —Learning subject examples—

- The three elements of security
  - ✓ Confidentiality
  - ✓ Integrity
  - ✓ Availability
- Security technology
  - ✓ Encryption
  - ✓ One-time passwords
  - ✓ Blockchain
  - ✓ Biometric authentication
- Information security management systems (ISMS)
- Security measures that individuals should take
  - ✓ ID and password management
  - ✓ Setting access rights
  - ✓ Prevention of screen viewing by others
  - ✓ Vigilance in regard to e-mails with attached files
  - ✓ Vigilance in regard to external e-mail addresses

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# How - Moral Issues

| Content | ● Has the sense of morality required in an age in which individuals can freely exchange information on the internet, and can communicate appropriately on the internet<br>● Knows about things that are prohibited in data analysis, such as fabrication, falsification, and plagiarism, and can use data appropriately<br>● Can imagine the hazards and impacts of data leakage |
|---|---|

## Explanation

- As actions that would be perfectly unremarkable in daily life can cause major problems in environments where information can easily be exchanged via the internet, business people need to equip themselves with an awareness of the moral issues involved in communicating appropriately.
- Business people need to use data appropriately, based on a full understanding of the fact that the illicit acquisition and fabrication of data for the purpose of reaching their desired conclusion is unacceptable.
- When using SNS and generative AI and the like, business people need to understand how the input information is used, and to enter appropriate information.
- When using data, business people must bear in mind the perspective of ethical, legal and social issues (ELSI), including ethical perspectives relevant to the accuracy of information and respect for others, legal perspectives associated with the understanding of copyright and the Act on the Protection of Personal Information, and social perspectives on the impacts of digital technology.

## —Learning subject examples—

- Examples of problems related to such matters as online harm, social media and generative AI, and measures to combat them
  - ✓ Leakage of addresses via location information from photographs
  - ✓ Account takeovers
  - ✓ Online flaming
  - ✓ Defamation rulings
  - ✓ Leakage of information via data entered on social media or into AI or search tools, etc.
  - ✓ Use of training data for generative AI, etc.

- Points for attention and things that are prohibited in the use of data
  - ✓ Fabrication of results
  - ✓ Plagiarism of experimental data
  - ✓ Cherry-picking of results
  - ✓ ELSI (Ethical, Legal and Social Issues)

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# How - Compliance

**Content**

- Knows about privacy, intellectual property rights and copyright, along with laws for their protection and data regulations in other countries
- When using data or technology in their actual work, can check that there are no problems with their work in light of laws, regulations and terms of use

## Explanation

- To ensure they do not violate the Act on the Protection of Personal Information when handling customer data at work or when disseminating information in their private life, business people must know the content signified by the term “personal information” and the rules for its handling.
- Business people must equip themselves with fundamental knowledge to ensure that they do not unintentionally infringe intellectual property rights in their work.
- Business people must know that each country has its own laws on data protection and that these also apply to individuals who handle information in Japan.

## —Learning subject examples—

- Definitions of personal information and laws related to personal information, along with points for attention regarding these
  - ✓ Act on the Protection of Personal Information
  - ✓ Rules for the handling of personal information
  - ✓ Privacy-related guidelines set out by industry groups, etc.
- Focus of protection under intellectual property rights
  - ✓ Copyright, patent rights, utility model rights, design rights, trademark rights
  - ✓ Unfair Competition Prevention Act
- Content of data regulations in other countries
  - ✓ GDPR
  - ✓ CCPA
  - ✓ Other regulations on the protection of industrial data
- Scope of data use in light of terms of use for services
  - ✓ Checks of how the service provider manages/uses entered data
  - ✓ Checks of usage rules within the company or organization

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# Chapter 4

# How the DSS-L Can Be Utilized

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# Ways of Utilizing the DSS-L

Organizations/companies, individuals and educational content providers are envisaged to be the main users of the DSS-L. Ways of utilizing the DSS-L tailored to their respective positions are shown below, along with specific examples thereof.

## Organizations/companies

- ✓Utilization as guidelines in deliberations concerning training systems that will equip employees with DX literacy
- ✓Utilization as material for deliberations on the direction of DX at the company that also indicates to management and employees the need to equip themselves with DX literacy in light of that direction

## Individuals

- ✓Utilization as guidelines to systematically design their studies and by selecting the content they will study from among the huge volume of DX-related articles, books, learning content and the like that is available around them

## Educational content providers

- ✓Utilization as guidelines for deliberations on what kind of content they should convey to a wide range of business people in the course of the development and provision of educational content on DX literacy

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# Ways of Utilizing the DSS-L - By General Category

| | Mindset and Stance | Why | What | How |
|---|---|---|---|---|
| **Goals of learning by general category** | To know the mindsets and stances required to produce new value against the backdrop of social change and have the ability to reflect on their own actions | To know how the values people regard as important and the socioeconomic environment are changing, and to understand the importance of DX | To know about data and digital technology as a means of DX promotion | To understand example uses of data and digital technology and learn how to use the basic tools for their utilization, and then to be able to actually use them in work, while also taking into account points for attention and the like |
| **Examples of utilization to achieve goals of learning** | | | | |
| **Organizations /companies** | Identification of the mindsets and stances that are particularly important in order for the company to generate new value, and deliberations on ways to ensure these become prevalent | Indication of the necessity and direction of DX within the company, in light of changes in the environment around the company | Indication to employees of data and digital technology that are important to the company's business, and provision of study opportunities | Indication to employees of the direction of the utilization of data and technology within the company and examples thereof, along with basic tools and points for attention in order to achieve this |
| **Individuals** | Acquisition of knowledge concerning the requisite mindsets and stances, along with reflection on their own day-to-day actions and attitudes | Understanding of changes in the world around them and consideration of impacts on the organization/company to which they belong and on their own lives | Study of data and digital technology in overview and consideration of the technologies behind data and tools encountered in familiar settings | Study of example uses, ways of utilization and points for attention, so that they can select and utilize the appropriate tools for the situation |
| **Educational content providers** | Introduction of mindset and stance action examples and associated methodologies | Explanation of why DX is required amid changes in the world around us, accompanied by the presentation of specific examples | Explanation of data and digital technology, linked to individuals' work and to familiar tools and services | Presentation of various example uses of data and digital technology, and means of achieving them (including the utilization of tools), along with the provision of opportunities to handle tools and explanation of points for attention |

The pages that follow provide specific utilization examples to provide a more concrete illustration of how the DSS-L can be utilized.

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# DSS-L Usage Examples - Mindset and Stance (1/2)

| | Examples of utilization | Specific examples |
|---|---|---|
| **Organizations/ companies** | Identification of the mindsets and stances that are particularly important in order for the company to generate new value, and deliberations on ways to ensure these become prevalent | ✓ Use of the mindsets and stances described in the standards as a point of reference to identify which mindsets and stances the company's organizations/human resources already have and which should be developed going forward<br>✓ Indication to employees of the mindsets and stances that are particularly important in the creation of new value and DX initiatives at the company, along with specific action examples<br>✓ Consideration of the requisite measures (organizational climate/structure, transformation of systems, etc.)—including those beyond employee education—to ensure the mindsets and stances whose future development are deemed particularly necessary become prevalent |
| **Individuals** | Acquisition of knowledge concerning the requisite mindsets and stances, along with reflection on their own day-to-day actions and attitudes | ✓ Acquisition of knowledge concerning the mindsets and stances that are important to the organization/company to which they belong and to their own work/business, along with reflection on their own day-to-day actions and attitudes<br>✓ Acquisition of knowledge concerning mindsets and stances other than the above that are laid out in the standards |
| **Educational content providers** | Introduction of mindset and stance action examples and associated methodologies | ✓ Explanation of mindset and stance action examples and associated methodologies in a manner that provides an understanding of which actions lead to the creation of new value (the obstacles encountered when individuals practice these mindsets and stances or during efforts to make them prevalent within an organization could conceivably be explained at the same time, along with ways to overcome these obstacles) |

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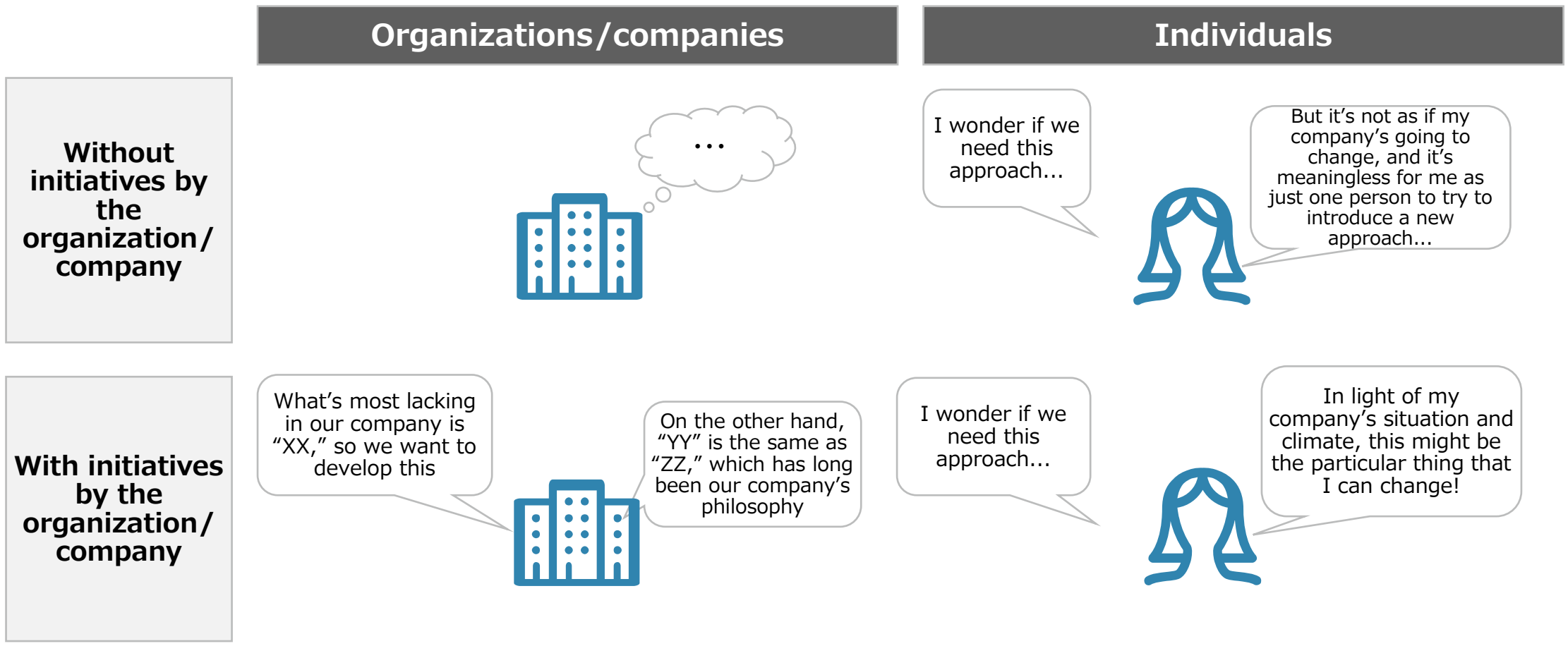
# DSS-L Usage Examples - Mindset and Stance (2/2)

- ✓ While mindset and stance are actions and attitudes required of individuals, initiatives at the organization/company level are necessary.
- ✓ It is desirable for organizations to indicate the mindsets and stances that they regard as important, to set out which of them are existing strengths of the organization, and to identify which they intend to continue to leverage going forward.

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# DSS-L Usage Examples - Why

| | Examples of utilization | Specific examples |
|---|---|---|
| **Organizations/ companies** | Indication of the necessity and direction of DX within the company, in light of changes in the environment around the company | ✓ Consideration of the impacts that social change is having on the company right now or could have on it in the future, and indication of these to employees<br>✓ Indication of the company's particular need for DX and direction thereof, in light of the impacts on it |
| **Individuals** | Understanding of changes in the world around them and consideration of impacts on the organization/company to which they belong and on their own lives | ✓ Selection and study of content related to the background to DX, while also referring to the standards<br>✓ Understanding of social change and consideration of the impacts that it is having on the organization/company to which they belong or could have on it in the future<br>✓ Reflection on how their own lifestyle is changing |
| **Educational content providers** | Explanation of why DX is required amid changes in the world around us, accompanied by the presentation of specific examples | ✓ Explanation of what changes are occurring in society and what role data and digital technology are playing in those changes, accompanied by examples likely to be familiar to numerous course participants<br>✓ For example, provision of specific instances of how data and digital technology can resolve social challenges, using examples tailored to the place where the course is being provided |

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# DSS-L Usage Examples - What

| | Examples of utilization | Specific examples |
|---|---|---|
| **Organizations/ companies** | Indication to employees of data and digital technology that are important to the company's business, and provision of study opportunities | ✓ Consideration of which data and digital technology will be particularly important to the company's future business and which of these the company wants to utilize going forward<br>✓ Provision of opportunities for employees to engage in study centered on the data and digital technology that will be particularly important to the company, along with data and digital technology not currently utilized, but which the company wants to utilize going forward |
| **Individuals** | Study of data and digital technology in overview and consideration of the technologies behind data and tools encountered in familiar settings | ✓ Selection and study of content related to knowledge of data and digital technology in overview, while also referring to the standards<br>✓ Efforts to think about the data and digital technology behind familiar tools and services used in their work or daily life |
| **Educational content providers** | Explanation of data and digital technology, linked to individuals' work and to familiar tools and services | ✓ Explanation not only of the definitions of keywords laid out in the learning subject examples in the standards, but also of how they are linked to individuals' work and to familiar tools and services, so that individuals feel greater familiarity with data and digital technology |

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# DSS-L Usage Examples - How

| | Examples of utilization | Specific examples |
|---|---|---|
| **Organizations/ companies** | Indication to employees of the direction of the utilization of data and technology within the company and examples thereof, along with basic tools and points for attention in order to achieve this | ✓ Introduction of example uses of data and digital technology within the company, so that employees feel a sense of familiarity with the utilization of data and technology<br>✓ If the utilization of data and digital technology has not progressed throughout the company, consideration of how data and digital technology could conceivably be utilized within the company and sharing of this information with employees<br>✓ Provision of opportunities to learn about the tools that are already utilized at the company<br>✓ Inspection of the company's existing training and rules to ascertain whether they cover security and moral issues |
| **Individuals** | Study of example uses, ways of utilization and points for attention, so that they can select and utilize the appropriate tools for the situation | ✓ Selection and study of content related to example uses, basic tools and points for attention, while also referring to the standards<br>✓ Tapping into their knowledge of example uses and basic tools in efforts to imagine how they could utilize data and digital technology in their company's business and their own work<br>✓ Study of points for attention in the utilization of data and tools, and efforts to utilize them in their own work |
| **Educational content providers** | Presentation of various example uses of data and digital technology, and means of achieving them (including the utilization of tools), along with the provision of opportunities to handle tools and explanation of points for attention | ✓ Provision of content that gives course participants a first-hand sense of the effects, if possible, with indication of ways of utilization, alongside specific situations in which they may be utilized, to make it easier for course participants to apply knowledge to their own work<br>✓ Along with explanation of basic general knowledge and knowledge of technical aspects, explanation of points for attention accompanied by the presentation of specific examples of things to which individuals should pay attention in daily life In addition, highlighting of accidents that can occur due to failure to pay attention to these things |

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# III. Digital Skill Standards for DX Promotion (DSS-P)

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# Chapter 1

# Aim of the DSS-P and Formulation Policy

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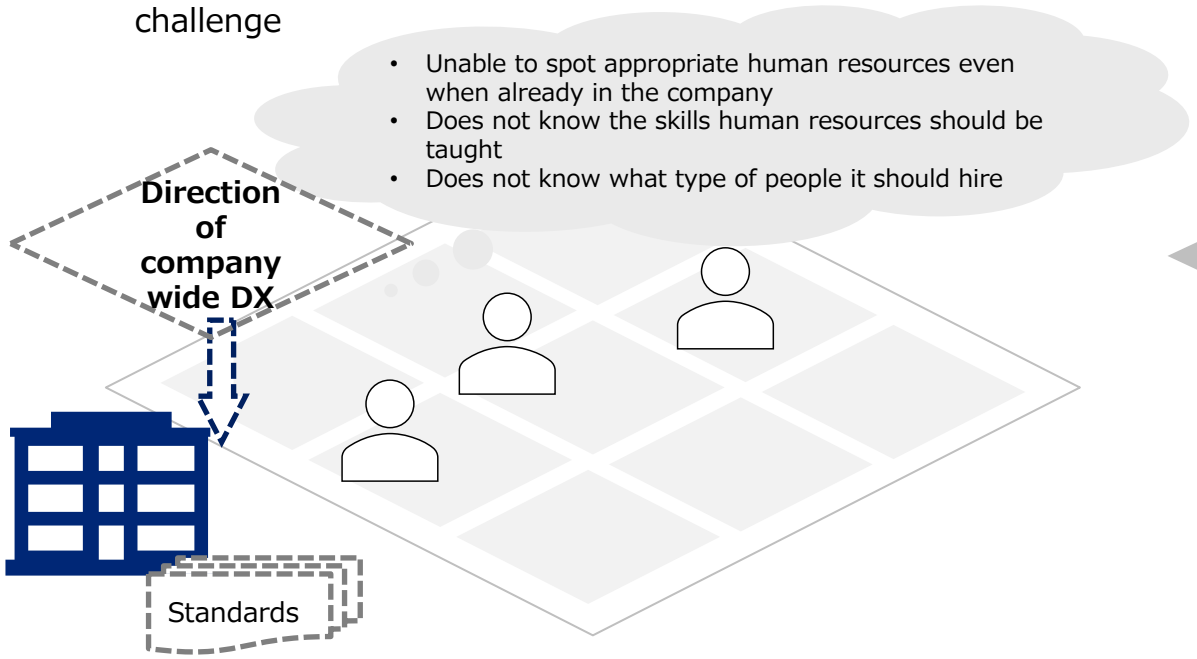
# The Need for the DSS-P

- The challenges thought to be behind the failure of Japanese companies to secure sufficient human resources who promote DX are the difficulties experienced by those companies in mapping out the direction of their DX and identifying what kind of human resources they require.
- When a company draws up a vision for what it wants to achieve through DX and strategies for its promotion, it is vital to appropriately identify what kind of human resources it needs to secure and cultivate to bring them to fruition. The DSS-P will be a useful point of reference in this process. However, companies must bear in mind that the skill standards should not be used as the basis for drawing up strategies, nor will they achieve progress in DX by haphazardly acquiring skills.

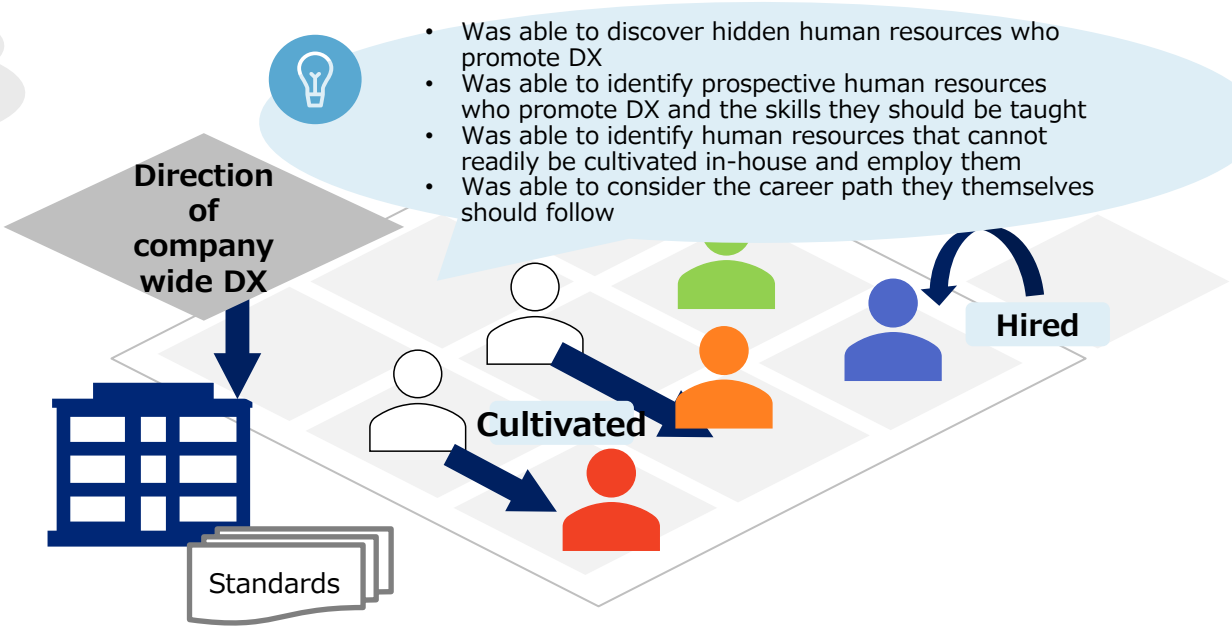
## Without the DSS-P (illustration)

- The company/organization has difficulty in identifying the human resources it requires, so it cannot set to work on efforts to secure/cultivate human resources who promote DX, and a shortage of human resources is potentially a challenge




## With the DSS-P (illustration)

- Referring to the DSS-P provides a clear understanding of the human resources required by the company/organization, so it has been able to set to work on efforts to secure/cultivate them

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# The Aim of the DSS-P

## Target audience for the DSS-P

- The DSS-P seeks to appeal to the following:
  - ✓ **Organizations/Companies** seeking to utilize data and digital technology to boost competitiveness, **regardless of business scale or degree of DX promotion**
  - ✓ **Individuals** promoting transformation that utilizes data and digital technology in organizations/companies

## The aim of the DSS-P

- Encouraging reskilling, creating forums for practical learning and visualizing skills by setting out the roles of human resources who promote DX and the knowledge and skills they acquire, and linking these to mechanisms for their cultivation

**Before utilizing the standards (illustration)**

40s
Director, Food Retail

- Wants to implement DX promotion initiatives, but has no human resources within the company who seem capable of it, and does not know **what kind of human resources with what knowledge and skills will be required**

50s
Manufacturing

- Was appointed to a role promoting a DX project within the company, but has no previous experience and does not know **what kind of knowledge and skills he needs**

**After utilizing the standards (illustration)**

- **Clarified the roles** that the company **should put in place as a priority**
- **Revised the content of training provided by the company** with a view to developing the requisite human resources

- **Clarified the knowledge and skills required** to promote the project
- **Has selected content and is engaging in study** with a view to acquiring them

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# DSS-P Formulation Policy

**POINT 1** **Sorts the human resources required for DX promotion into 5 types and defines them**

The DSS-P defines the key human resources required for DX in companies/organizations as 5 **human resource types: (business architects/designers/data scientists/software engineers/cyber security)**

**POINT 2** **Defines 2-4 roles on the basis of differences in their functions and the settings where they are active**

Within each human resource type, the DSS-P defines 2-4 roles that envisage differences in their functions and the settings where they are active. Allows for flexible usage tailored to differences in the division of roles when promoting DX in diverse organizations/companies, **including the possibility that one human resource might hold multiple roles concurrently or that multiple human resources might be responsible for one role**

**POINT 3** **Defines the skills and knowledge required of each role in broad groupings**

Defines the skills and knowledge required of each role in broad groupings as a **List of Common Skills common to all human resource types.** Lightweight definitions of skills and knowledge facilitate a swift, flexible response to technological changes required in the digital age

**POINT 4** **Provides learning subject examples to facilitate understanding of the education and training required for cultivation**

The List of Common Skills provides “learning subject examples” associated with each skill. This will enable the learning subject examples to be associated with education and training, etc. to develop the human resources required for DX promotion

**POINT 5** **Envisages levels at which an individual will be able to execute work singlehandedly and also to cultivate successors**

Overall, rather than setting detailed indicators for evaluating levels, the DSS-P envisages levels **equivalent to ITSS+ Level 4*** (Able to execute work singlehandedly and also to **cultivate successors**)

*ITSS+ Definitions of Common Levels (https://www.ipa.go.jp/jinzai/skill-standard/plus-it-ui/itssplus/ps6vr70000001j6e-att/000065687.pdf )

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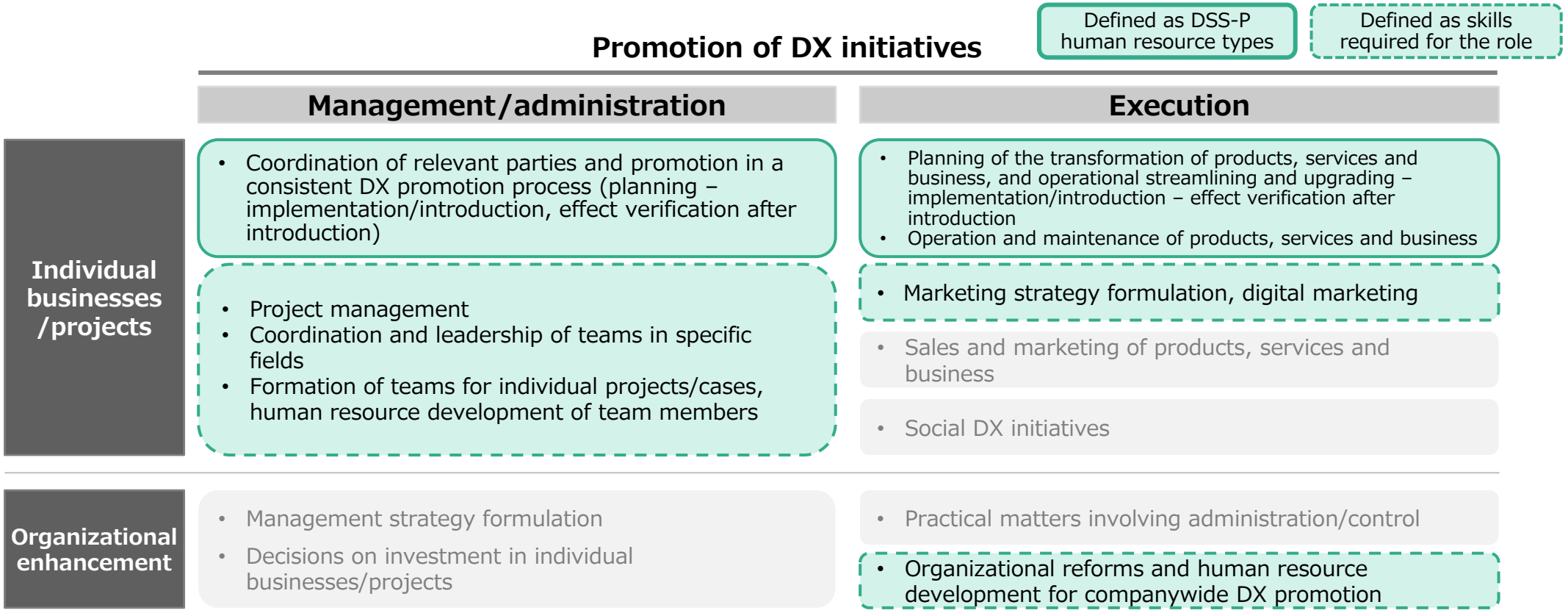
# Scope of the DSS-P Human Resource Types

- As those responsible for project management, coordination of teams in specific fields, companywide organizational reforms, human resource development and marketing may differ according to the nature of a project, these are not defined as independent roles, but rather defined as skills required for the role.
- The DSS-P explicitly does not include definitions of roles and skills that individuals should equip themselves with in relation to management with responsibility for the entire company, operations specific to administration or sales and marketing, and the following functions associated with social initiatives.
  - Organizational enhancement: Management strategy formulation, decisions on investment in individual businesses and projects, and administrative and practical matters involving administration and control
  - Individual businesses and projects: Sales and marketing of products, services and business, and social DX initiatives

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# Chapter 2

# Structure of the DSS-P

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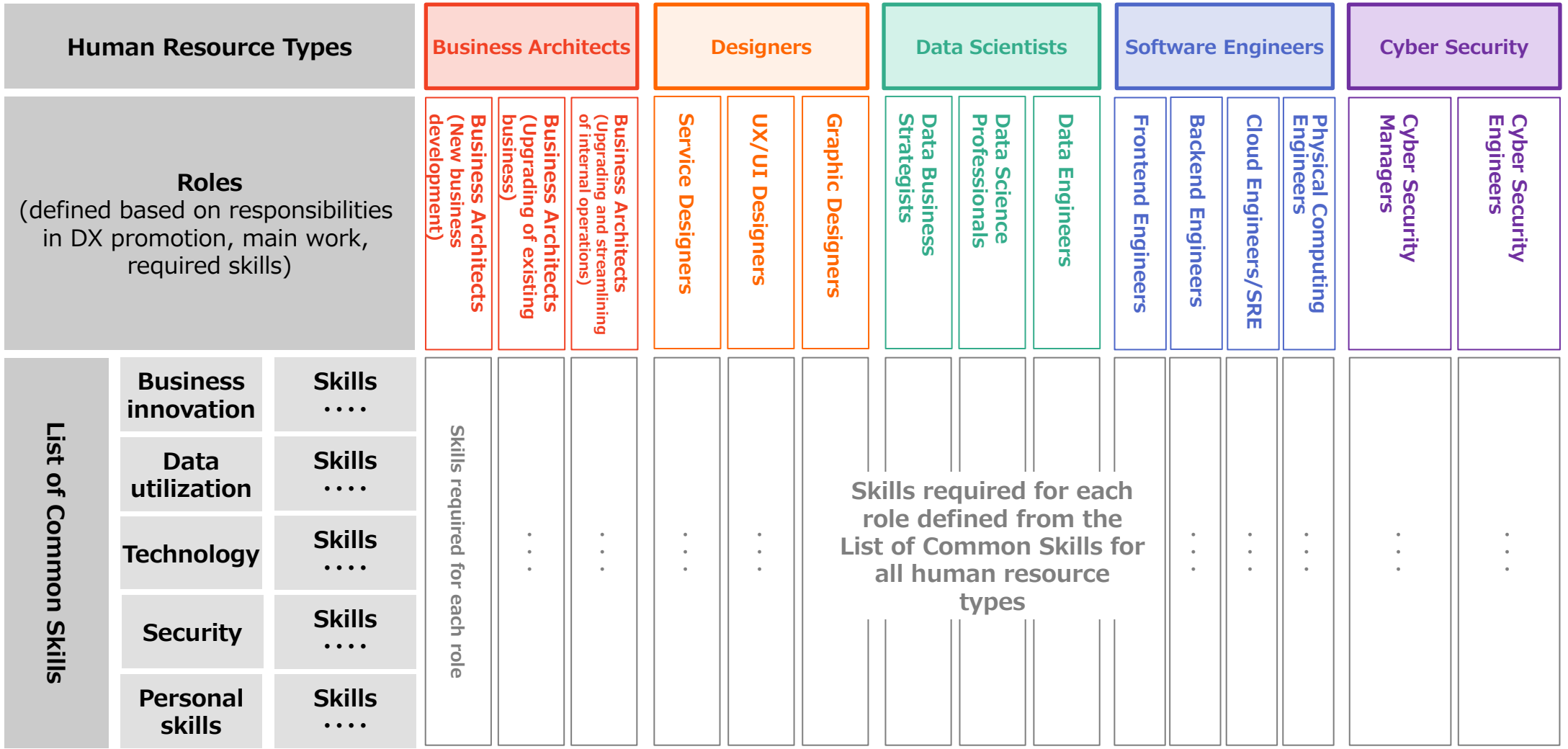
# Structure of the DSS-P

- The DSS-P is formed of five human resource types, roles that form a subdivision of this, and a list of common skills that apply to all human resource types and roles.
- “Role” refers to the further subdivision of human resource types by differences in work to make utilization easier for organizations, companies and individuals.

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# Structure of the DSS-P | Definition of Terms

- The definitions of terms relating to the human resource types, roles and skills comprising the DSS-P are as follows:

| Term | Definition |
|---|---|
| **Human Resource Types** | The human resources required for DX promotion in companies/organizations divided into 5 types<br>(business architects/designers/data scientists/software engineers/cyber security) |
| **Roles** | The further subdivision of a human resource type by differences in work<br>*A single individual may hold multiple roles concurrently |
| **Responsibilities in DX Promotion** | The mission that each role should fulfill in promoting DX |
| **Main Work** | The work/operations/tasks that it is thought each role should carry out to fulfill the aforementioned responsibilities |
| **Skills** | Items such as knowledge and skills deemed necessary to the execution of operations in DX promotion at companies/organizations |
| **Learning subject examples** | Examples of content that is expected to be learned for acquisition of a skill<br>*As the learning subject examples are merely examples, the acquisition of all of them is not essential |

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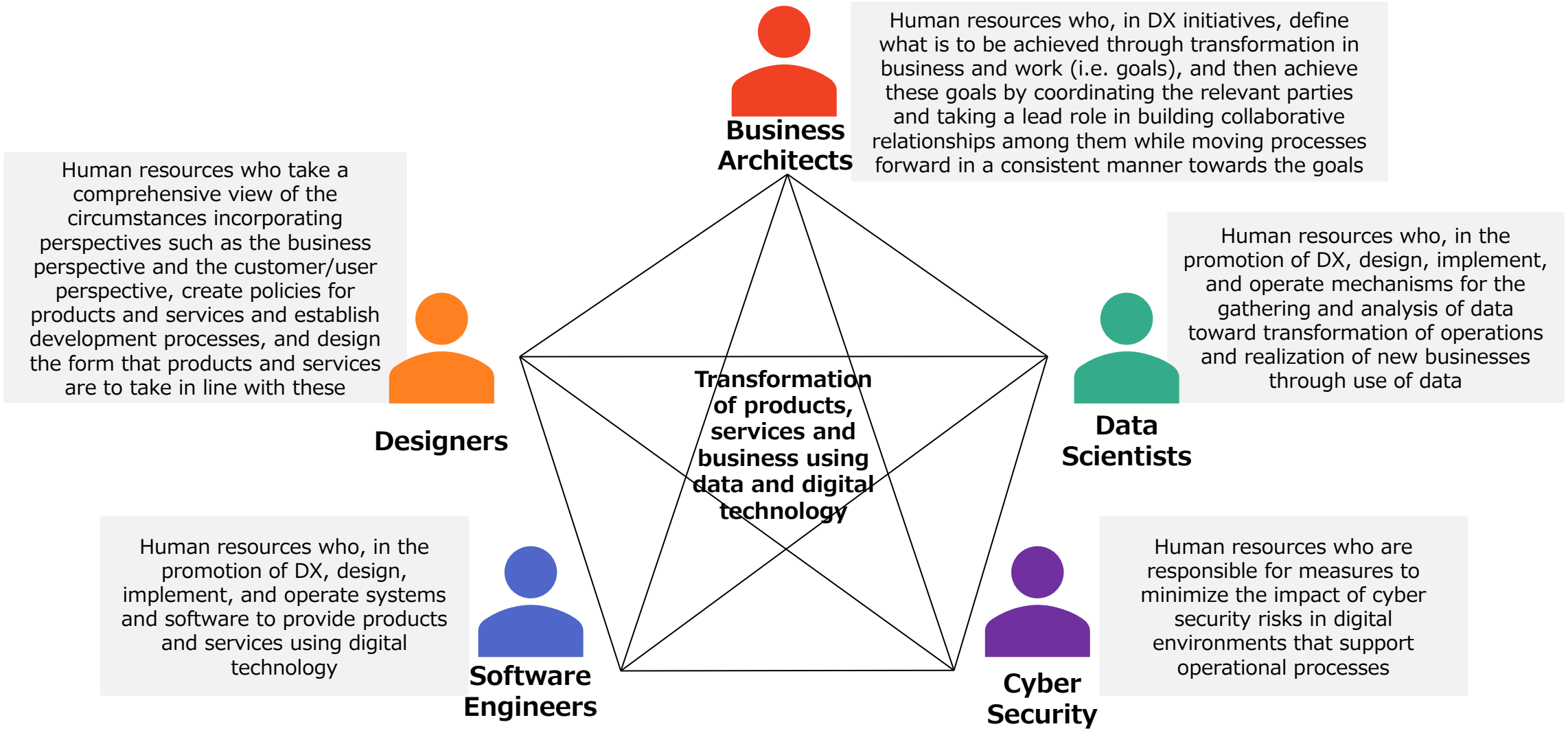
# Definition of Human Resource Types

- This defines the five main human resource types for DX promotion.
- It is important for human resources who promote DX to get other types of human resources involved and provide help to other types after first proactively building connections with these other types of human resources. It is also important to proactively look for suitable human resources both internally and externally.

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# Collaborating between Human Resource Types

- Human Resource Types & Roles gives a specific description of collaborating between each type.
- Rather than assuming that one role gives instructions or requests to another role, this assumes that two or more roles build a collaborative working relationship in a range of situations.

| | Business Architects | Designers | Data Scientists | Software Engineers | Cyber Security |
|---|---|---|---|---|---|
| **Business Architects** | | | | | |
| **Designers** | • Consideration of ideas for products and services based on insights derived from the results of customer and user surveys | | | | |
| **Data Scientists** | • Consideration of ideas for products and services based on hints obtained from the results of data analysis | • Consideration of surveys, data acquisition, analysis, and how to present analysis results for verification of customer/user understanding and products/services | | | |
| **Software Engineers** | • Consideration of ideas for products/services based on new technology and tool<br>• Definition of requirements for development based on customer needs, and software architecture design<br>• Determination of priority in development | • Development, evaluation, and verification of products/services, while taking into consideration design guidelines, usability and ethical appropriateness | • Consideration of new mechanisms for collecting/accumulating/ analyzing/visualizing data, and mechanisms for linking/connecting with existing systems, etc. | | |
| **Cyber Security** | • Consideration of optimum measures for product/service risks taking the balance of costs/risks into consideration<br>• Consideration of new rules corresponding to risks | • Consideration of user interfaces to decrease the feeling of burden on users due to security enhancement | • Consideration of policies concerning data management and privacy protection | Creation of security rules and countermeasures corresponding to risks for new products/services | |

# List of Roles

- The DSS-P further subdivides human resource types into the roles described below.

| Human Resource Types | Roles | Responsibilities in DX Promotion |
|---|---|---|
| Business Architects | **Business Architects (New business development)** | Identify the goals of new business and products and services, set out the method for achieving the newly defined goals, and then achieve these goals by coordinating the relevant parties and taking a lead role in building collaborative relationships among them while moving processes forward in a consistent manner towards the goals |
| | **Business Architects (Upgrading of existing business)** | Rethink the goals of existing business and products and services, set out the method for achieving the redefined goals, and then achieve these goals by coordinating the relevant parties and taking a lead role in building collaborative relationships among them while moving processes forward in a consistent manner towards the goals |
| | **Business Architects (Upgrading and streamlining of internal operations)** | Define goals for problem solving in internal operations and set out the method for achieving these goals, and then achieve these goals by coordinating the relevant parties and taking a lead role in building collaborative relationships among them while moving processes forward in a consistent manner towards the goals |
| Designers | **Service Designers** | Define customer value in the context of society, customers and users, and the challenges and actions of both internal and external involved parties in the provision of products and services, create policies (concepts) for products and services, and design mechanisms for continuously realizing them |
| | **UX/UI Designers** | Design customer/user experience for products and services based on value propositions*, undertake the information design of products and services, and design functions, information deployment, appearance, and dynamic elements |
| | **Graphic Designers** | Create concrete realizations of brand image, and design digital graphics, marketing media, and other such things with a sense of unification as a brand |
| Data Scientists | **Data Business Strategists** | Consider data utilization strategy in line with enterprise strategy, and lead the way in realizing and executing the strategy while achieving business transformation to increase customer value and creating new business |
| | **Data Science Professionals** | Use data processing and analysis to elicit meaningful knowledge that will lead to operational transformation and business creation to increase customer value |
| | **Data Engineers** | Realize operational transformation and business creation to increase customer value through the design, implementation, and operation of an effective data analysis environment |
| Software Engineers | **Frontend Engineers** | Take the main responsibility for mainly implementing interface (client-side) functions among software functions for providing services that leverage digital technology |
| | **Backend Engineers** | Take the main responsibility for mainly implementing server-side functions among software functions for providing services that leverage digital technology |
| | **Cloud Engineers/SRE** | Take responsibility for developing the software to provide services that use digital technology, optimizing the operating environment, and increasing its reliability |
| | **Physical Computing Engineers** | Undertake digitalization of the real world (physical domain) and take responsibility for implementing software functions, including for devices, in the implementation of software for the provision of services utilizing digital technology |
| Cyber Security | **Cyber Security Managers** | In the formulation of business plans to increase customer value, consider and evaluate cyber security risks resulting from the use of digital technology and take the lead in the management and control of measures to limit the impact in order to contribute to increase sense of trust in the business as one that provides high customer value |
| | **Cyber Security Engineers** | Implement, maintain, and run measures to limit cyber security risks relating to the use of digital technology in business in order to contribute to the stable provision of business offering high customer value |

Note: Value proposition: The benefit provided to customers who purchase a company's product or service, or the reason that customers should buy the product or service, as determined on the basis of business capabilities having first gained an understanding of the value demanded by customers

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# Revision of the DSS-P on Generative AI <Summary> (July 2024)

- It is important for human resources who promote DX to capture the changes brought about by newly emerging, impactful digital technologies (hereinafter called “new technologies”) .
  To this end, **supplementary information** on approaches and actions on new technologies required of human resources who promote DX **has been added**.
- Assuming that the roles of human resources do not change, the human resource types and roles were left the same and **additions/changes were only made to the examples of learning subjects in the List of Common Skills.**

**Aims of the Establishment of the Standards** — No revision

**Human Resource Types & Roles** — No revision

## Premise

### 1 Characteristics of Generative AI

Added supplementary info

■ General **characteristics** (including definitions of terms), **usefulness**, and **risks** of generative AI were added to achieve a common understanding.

### 2 How to Approach/Take Actions on New Technologies (Including Generative AI)

■ Going forward, new technologies that bring about changes to business and operations are expected to appear and demand our adaptation just like generative AI. To this end, definitions for **approaches and actions on new technologies required of human resources who promote DX** were added.

## Actions on Generative AI

### 3 Basic Approach: Utilize and Develop/Provide

■ To define actions for generative AI, the following viewpoints on generative AI, which will become the basic approach for Supplementary Information 4 onwards* were added.

✓ **Utilize**: Utilize publicly available generative AI in operations; Utilize generative AI **incorporated into the** organization/company’s operational processes.

✓ **Develop/Provide**: **Develop products and services that incorporate generative AI** that contribute to the operational processes of the business/organization and **provide them to customers and users.**

### 4 Detailed Definitions

■ In order to promote a better understanding of actions taken on generative AI, the **processes, contents, and points to consider** that are common to all human resource types when **utilizing** and **developing/providing** generative AI were added.

### Examples

#### 5 Example of Utilizing Generative AI in Operations as an Individual

■ In order to evoke an image of **utilizing** generative AI, examples of utilizing publicly available generative AI in operations and utilizing generative AI incorporated into the organization/company’s operational processes were added.

#### 6 Example of Actions Taken When Developing/Providing Generative AI Products and Services for Business and Operational Processes

■ In order to evoke an image of **developing/providing** generative AI, examples of the key actions taken by each human resource type when incorporating generative AI into products and services for business and operational processes were added.

**List of Common Skills** — Revised

■ In response to changes in actions required of human resources who promote DX, additions/changes were made to **“Data Utilization”** and **“Technology”** category learning subject examples.

*:Quoted “AI Developer” and “AI Provider” from “AI Guidelines for Business (Version 1.0)” (April 2024)

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# 1 Characteristics of Generative AI*

**What is generative AI?**

✓ A general term for **AI models** (models obtained through machine learning using training data, which generate prediction results according to input data) **that can generate sentences, images, audio, movie, programs, etc.**

**The potential for generative AI**

✓ Generative AI has the potential to unlock major business opportunities by **improving Japan's productivity and added value**. By strengthening Japan's **ability to develop generative AI (foundation models)**, further innovation which could possibly **contribute to solving various social issues** can also be expected.

✓ From a sustainability viewpoint, generative AI is expected to contribute to the sophistication and improved efficiency of operations, which will bring about **various advantages in the economic, social, and environmental aspects.**
On the other hand, **increases in energy consumption and costs** due to generative AI will need to be addressed.

## Key expected usefulness

✓ Generative AI can learn a large amount of data and demonstrate a high ability in tasks such as **summarizing, analyzing, and making proposals**, as well as **assisting** humans **in making decisions.**

✓ Thanks to **its advanced ability to interact in natural languages** and improved user interfaces, many people can now easily use AI for a variety of purposes. Therefore, there is **a great opportunity to use generative AI** not only to **transform a company's business processes and organizational setup**,
but also to **improve and transform the customer experience of the services and products the company provides.**

## Key expected risks

✓ Depending on **specific characteristics of technical elements** (training data, model training process, input method, information referenced when AI models reason, external services to link the AI with, etc.) and **user actions,** there is a risk that **incorrect information or results that are inappropriate from a business, operational, ethical, or legal perspective are output and taken at face value.**

✓ There are the risks of **the infringement of rights, information leakage and ethical issues,** and the like due to the speed and complexity with which AI technology is developed and implemented in society, as well as the **differences in the development and enforcement of laws and guidelines between Japan and other countries**.

*Reference: Study Group on Human Resources Policy in the Digital Age, "Approaches to human resources and skills required for DX promotion in the age of generative AI," August 2023
Ministry of Internal Affairs and Communications; Ministry of Economy, Trade and Industry, "AI Guidelines for Business (Version 1.0)," April 2024
Ministry of Economy, Trade and Industry, Generative AI Accelerator Challenge (GENIAC), February 2024

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# 2 How to Approach/Take Actions on New Technologies (Including Generative AI)

- Generative AI is a new technology that will have a major impact on society, organizations, and individuals; it has the potential to bring further transformations in business and operations. Considering the recent rapid changes in digital technology, **emergence of new technologies such as generative AI is expected to continue going forward**.
- As the ability to proactively capture changes brought about by new technologies and appropriately employ them to trigger transformation will become imperative for human resources who promote DX, **approaches and actions on new technologies** required of such resources were defined as follows.

## Approaches and actions on new technologies such as generative AI required of human resources who promote DX

| | |
|---|---|
| **Ascertain the impact and risk of new technologies based on on-hands experience** | ✓ **Maintain interest in new technologies and understand their characteristics (usefulness, risks, etc.) by actually using them. Then, set objectives to achieve (for business and operational transformation) and ascertain the feasibility of achieving the objectives, as well as the impact and risk the new technologies will have on society, organizations, and individuals.**<br>• **Impact**: Scope and depth of the impact from the new technologies, such as the resolvement of social issues or transformation of the industrial structure<br>• **Risk**: Risks to business and operations that can be expected from the speed of technological development, complexity of implementation, development of relevant laws, degree of ethical literacy that has developed, etc. |
| **Build frameworks for using new technologies and promote transformation into organizations/human resources that promote DX** | ✓ **Have different human resource types work together to conceptualize and build frameworks for safely creating value using the new technologies; start early and on a small scale.<br>Review the situation periodically and provide the optimal framework.**<br>✓ **Within the frameworks that were built, aim to create new value, improve the quality of the output, and produce transformative results.<br>Furthermore, enhance the abilities of all human resources and encourage transformation into organizations/human resources that promote DX.** |
| **Continually acquire skills to meet the speed of change in new technologies** | ✓ **Continually acquire and improve the skills necessary to maximize the benefits of new technologies to meet the speed of their changes.** |

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Utilize
Develop/ Provide

# 3 Actions on Generative AI: Basic Approach

- In order to address the changes in the skills required of human resources who promote DX, the DSS-P has been revised from the **perspective of utilizing generative AI and developing/providing* products and services that incorporate generative AI**. It is expected that the use of the Digital Skill Standards and Digital Governance Code 2.0 will continue to support efforts to secure and develop human resources and execute businesses' DX visions and strategies based on the company-wide DX policy. (See page 8)

**DX Vision/Strategy** ⟷ **Human Resources**

## Digital Governance Code 2.0

## Digital Skill Standards

Target of this time's revision

### Digital Skill Standards for DX Promotion (DSS-P)

Defines roles and required skills of human resource types who promote DX

**Develop/Provide**

✓ Human resources who promote DX develop products and services that incorporate generative AI for business and for their own organization's business processes, and provide them to customers and users

**Utilize**

✓ Human resources who promote DX utilize generative AI in the following ways:
- Utilize publicly available generative AI in operations
- Utilize generative AI incorporated in their organization/company's operational processes

### Digital Skill Standards for DX Literacy (DSS-L)

Defines skills that all business people should equip themselves with (revised on August 2023)

**Try to Use**

✓ Try to use publicly available generative AI

**Learn/Research**

✓ Spread one's antennae and learn about new technologies
✓ Research any unfamiliar words encountered to expand knowledge

*:Quoted "AI Developer" and "AI Provider" from "AI Guidelines for Business (Version 1.0)," April 2024

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Utilize
Develop/ Provide

# 4 Actions on Generative AI: Detailed Definitions (1/3)

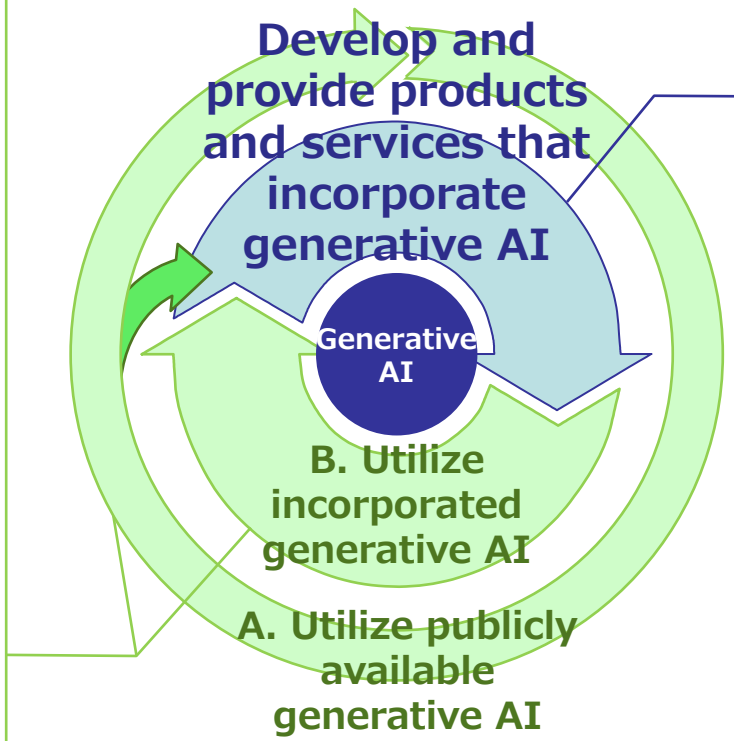
- Human resources who promote DX must understand technical elements and laws related to generative AI and contribute to achieving the objectives and solving the problems of an organization/company by:
  - Utilizing publicly available generative AI or generative AI incorporated in the organization/company's operational processes
  - Develop products and services that incorporate generative AI that contribute to the operational processes of their business/organization/company and provide them to customers and users.

## Utilize

*Specific examples are described in 5

■ Human resources who promote DX utilize **(A) publicly available generative AI** and **(B) generative AI incorporated in the organization/company's operational processes** to achieve operational sophistication and efficiency. This shall be done with the following additional points in mind:

- Experience using publicly available AI **(A)** before considering incorporating generative AI in their business/organization's operational processes
- Consider whether to review the environment based on the utilization situation of generative AI incorporated in their organization's operational processes (**B**)
- In both **A and B**, ensure to observe the rules and assess the risks in advance




## Develop/Provide

*Specific examples are described in 6

■ Human resources who promote DX **develop products and services that incorporate generative AI that contribute to the operational processes of their business or organization and provide them to customers and users**. This shall be done with the following additional points in mind:

- Repeat the verification of the usefulness and effectiveness of generative AI in short cycles
- Be aware of the risks involved in handling data, such as the infringement of rights, information leakage and ethical issues
- Based on the utilization situation of the generative AI and feedback from customers and users, re-examine/develop concepts and environments

Digital Skill Standards for DX Literacy level for understanding generative AI (technical elements and laws related to generative AI)*

*Also see the task list stipulated in the ITSS+ (Data Science Domain): https://www.ipa.go.jp/jinzai/skill-standard/plus-it-ui/itssplus/data_science.html

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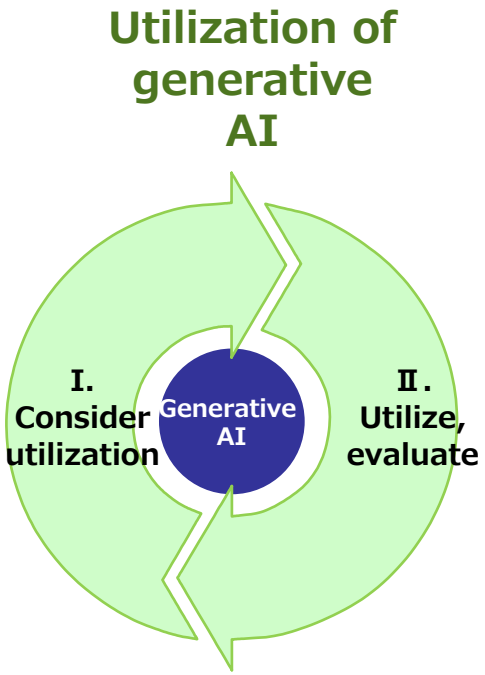
Utilize

Develop/ Provide

# 4 Actions on Generative AI: Detailed Definitions (2/3)

- The process and points to note when human resources who promote DX utilize generative AI are as follows:




## Process for utilizing generative AI

**Ⅰ. Consider utilization**

**Consider when, where, and how to utilize generative AI**
Consider how and when/where AI can be used to create value based on the fact that AI has become easier to use

**Ⅱ. Utilize, evaluate**

**Appropriate evaluation and utilization of output results**
Appropriately evaluate results output by AI from various viewpoints including accuracy and possibility of copyright infringement. Use the results to deepen and expand your area of expertise and achieve operational efficiency and sophistication.

## Points to note when utilizing generative AI

**Business viewpoint**

- Appropriately evaluate issues such as unexpected output results, ethical issues and the infringement of rights using not only skills related to generative AI, but also skills suited for the business or operation being addressed
- Even though results output by AI are generated based on an efficient and rationalized process, use critical thinking to judge whether those results are appropriate in terms of the criteria for making business/operational decisions

**Technology viewpoint**

- Depending on the AI service/system being used, different prompting methods may be required
- Understand the characteristics of the AI service/system being used; consider the strengths and weakness in its applications

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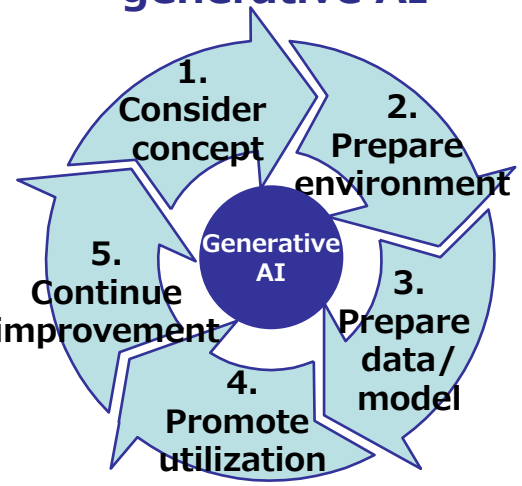
Utilize

Develop/ Provide

# 4 Actions on Generative AI: Detailed Definitions (3/3)

- The process and points to note when human resources who promote DX develop products and services that incorporate generative AI that contribute to their business or the operational processes of their organization and provide them to customers and users are as follows:

## Develop and provide products and services that incorporate generative AI




### Process for developing and providing products/services that incorporate generative AI

| | |
|---|---|
| **1. Consider concept** | **Formulate concept of product/service**<br>Formulate the objectives and concept for business/operational transformation and new value creation. Formulate concept of product/service that incorporates generative AI for development and provision. |
| **2. Prepare environment** | **Prepare environment for implementation, operation, and utilization**<br>Define system configuration for implementing generative AI. Build environment and formulate guidelines for addressing risks and issues. |
| **3. Prepare data/ model** | **Design, develop, evaluate**<br>Configure generative AI (fine tuning, RAG*, etc.) according to purpose; consider, collect, evaluate necessary data. Implement the generative AI while giving consideration to factors such as integration with existing systems and appropriate UI. |
| **4. Promote utilization** | **Establish the generative AI and build a team/setup for operating the product/service**<br>Share know-how on utilizing the generative AI, input methods, etc. Plan/promote measures to improve the skills of customers and users based on formulated guidelines; build a team/setup for operating the product/service. |
| **5. Continue improvement** | **Continue to improve the quality of generative AI**<br>Monitor for security concerns and changes in the generative AI that result from usage by customers and users as well as updates to the model. Adjust settings and review the environment based on operational evaluation. |

*Retrieval-Augmented Generation

### Points to note when developing and providing products/services that incorporate generative AI

| | |
|---|---|
| **Business viewpoint** | ■ Also consider sustainability as well as possible impacts such as the product/service changing the business fundamentally or replacing human labor in tasks that were conventionally done by humans.<br>■ Continuously monitor the contents of data and usage of the generative AI while giving consideration to factors such as the risks of the infringement of rights, information leakage and ethical issues, and establishment of new laws/regulations. |
| **Technology viewpoint** | ■ Since any kind of data may be input (used for training) into the generative AI, it is becoming more important to ensure that data is in a distinguishable state (machine readability of the data) and to maintain data quality (errors, bias, incompleteness, etc.).<br>■ Understand that the skills required will differ depending on whether multimodalization (processing of multiple inputs such as images, audio, and text) is adopted and the type and format of information that will be accepted for input. |
| **Operations viewpoint** | ■ Develop guidelines, build an operating team, and prepare customer/user environments while keeping note that customers and users with no knowledge on generative AI will also use the product/service. |

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Utilize

Develop/ Provide

# 5 Examples of Utilizing Generative AI in Operations as an Individual

- Below are some examples of how individuals can utilize generative AI. By utilizing or trying to utilize generative AI as described below, business people striving to become human resources who promote DX can gain digital experience and skills in a short period of time.
- Human resources who promote DX should consider what approach they can take toward the organization/company's DX vision and strategy while using generative AI themselves. The incorporation of generative AI into business and operational processes is expected to lead to the DX of the organization/company.

## Utilization by human resources who promote DX

**Examples usages of publicly available generative AI or generative AI incorporated in the operational processes of organizations/companies**

**Summarize, research, make proposals**
- ■ Summarize market information and feedback from customers of existing business
- ■ Propose ideas when considering new products and services

etc.

**Generate designs**
- ■ Generate sample designs in order to compare multiple designs

etc.

**Generate data, support programming**
- ■ Generate test data to check proper functioning of the analysis tool
- ■ Support programming work (e.g., review and correct code)

etc.

**Generate documents, support tests**
- ■ Generate design drafts that summarize programming content
- ■ Generate data samples for conducting system tests
- ■ Generate and execute simple scenarios for system testing

etc.

**Detect and report security issues**
- ■ Generate reports of abnormal actions on the system
- ■ Generate reports on the cause of detected security issues

etc.

*1: This page describes examples of utilizing generative AI; when using generative AI, sufficient care must be taken to the infringement of rights, information leakage and ethical issues, etc.
*2: For usage examples of generative AI, also refer to documents such as: Study Group on Human Resources Policy in the Digital Age, "Approaches to human resources and skills required for DX promotion in the age of generative AI," August 2023; Ministry of Internal Affairs and Communications; Ministry of Economy, Trade and Industry, "AI Guidelines for Business (Version 1.0)," April 2024

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Utilize
Develop/ Provide

# 6 Examples of Actions Taken When Developing/Providing Generative AI Products for Business and Operational Processes

- Examples of the key actions taken by each human resource type when developing products and services that incorporate generative AI that contribute to their business or the operational processes of their organization and providing them to customers and users are described below. Collaboration among human resource types and flexibility become the key.

## 1. Consider concept

Business Architects
Designers
- Formulate **architecture (including business model)**
- **Define value** brought from generative AI (customer/user experience and so on)

Data Scientists
- Consider **generative AI and data utilization strategy**

Software Engineers
- Conduct technical **research** of generative AI such as **model** and **API**, **share** research results

Cyber Security
- Conduct **legal research** of generative AI and data handling, **share** research results

## 2. Prepare environment

Business Architects
Designers
- List out all business/operational **requirements**
- Formulate a **policy** for addressing expected **risks/issues**
- **Consider measures** for appealing value to customers and users

Data Scientists
Software Engineers
- **Select** a generative AI model
- Define **system configurations**, create a **development environment** (e.g., cloud)

Cyber Security
- Design security **operation and security governance policies**
- Consider **points to monitor**
- Formulate **security architecture**

## 3. Prepare data/model

Business Architects
- **Present output result examples** from a business/
- operational viewpoint, **evaluate beforehand**

Data Scientists
Software Engineers
- **Collect/prepare** data, **configure** generative AI model **(tuning, RAG*), evaluate quality**
- Configure **data linkage** (e.g., API) with related systems

Designers
- Design and implement customer/user **UX/UI**

Cyber Security
- Design and implement security **requirements** (confidential information, person information, etc.)

*Retrieval-Augmented Generation

## 4. Promote utilization

Business Architects
Designers
- Formulate **guidelines, build team/setup**
- **Consider policies** on promoting utilization**, plan and promote** a framework
- **Appeal value** brought from new products/services and operational processes

Data Scientists
Software Engineers
- Formulate **operation manuals** for stable operation

Cyber Security
- Continually **be aware of and keep well informed** of risks

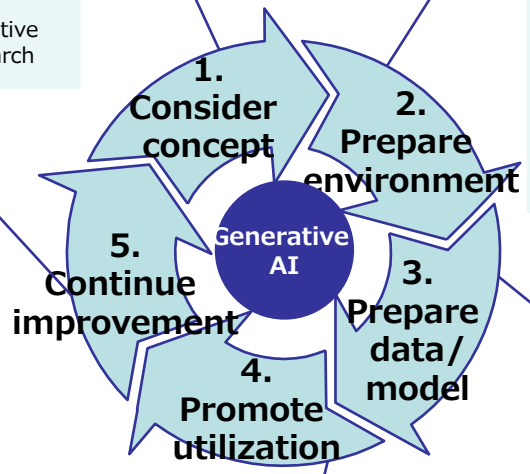
## 5. Continue improvement

Business Architects
- Review **architecture**, consider **improvement measures**
- **Evaluate** data and generative AI from a business and operational viewpoint

Designers
- **Review and improve** architecture and **UX/UI**, collect utilization examples

Data Scientists
Software Engineers
- **Conduct monitoring** (data, generative AI model, environment, data linkage, etc.), **get feedback, perform maintenance on data, review settings**

Cyber Security
- Monitor for **cyber attacks, unauthorized use, generative AI health, etc.**




*1: This page describes examples of key actions based on the general role of each human resource type; flexibility is expected to accommodate the situation of the organization/company and the purpose of developing and providing generative AI products and services.
*2: This page describes usage examples of generative AI; when using generative AI, sufficient care must be taken to avoid the infringement of rights, information leakage and ethical issues, etc.

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# Revisions to the List of Common Skills (July 2024)

- Although there are no changes to the categories, subcategories, or skills themselves, due to the impact of generative AI, the learning subject examples in the following areas were changed:

| Revised part | | | Reason for revision, content |
|---|---|---|---|
| Category | Subcategory | Skill | |
| Data utilization | ■ Strategic utilization of data/AI | ■ Data understanding/ utilization<br>■ Design, implementation, and evaluation of operations that utilize data/AI | ■ The “data utilization” category referenced Japan DataScientist Society’s Skills Checklist.<br>As this checklist was revised in October 2023 to add items related to generative AI in addition to reconsidering the entire checklist including the details of the listed skills as well as the category structure, the changes were reflected to the learning subject examples of the skills on the left.<br><br>Words which were added to the learning subject examples of skills related to generative AI are as follows:<br>・Approach design (…, generative AI utilization, …)<br>・Large language model, image generation model, audio generation model<br>・Programming (…, AI service utilization, …)<br>・Generative AI (prompt engineering, coding support, fine tuning, technical utilization of generative AI, generative AI development)<br><br>*See pages 148 to 150 for relation to Skills Checklist |
| | ■ AI/data science | ■ Mathematical statistics/multivariate analysis/data visualization<br>■ Machine learning/deep learning | |
| | ■ Data engineering | ■ Data utilization infrastructure implementation/ operation | |
| Technology | ■ Digital technology | ■ Technology trends | ■ In this revision, based on the premise that there will be no major review of skills, and as Supplementary Information 2 mentions the need to catch up with trends in new technologies, “Generative AI” was added to the learning subject examples of the related skills. |

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# Overview of the List of Common Skills

- The List of Common Skills that applies to all human resource types sorts skills required for human resources who promote DX into five categories and 12 subcategories.
- Each category is divided into two or more subcategories, and broadly sets out the skills with the main activities in the first one, and elemental technologies and methods that support this from the second one onward.

| Category | Subcategory | Skills |
|---|---|---|
| Business transformation | Strategy/management/systems | Business strategy formulation and execution |
| | | Product management |
| | | Transformation management |
| | | Systems engineering |
| | | Enterprise architecture |
| | | Project management |
| | Business model/processes | Business surveys |
| | | Business model design |
| | | Business analysis |
| | | Verification (business perspective) |
| | | Marketing |
| | | Branding |
| | Design | Customer/user understanding |
| | | Value discovery/definition |
| | | Design |
| | | Verification (customer/user perspective) |
| | | Other design technology |
| Data utilization | Strategic utilization of data/AI | Data understanding/utilization |
| | | Data/AI utilization strategy |
| | | Design, implementation and evaluation of operations that utilize data/AI |
| | AI/data science | Mathematical statistics/multivariate analysis/data visualization |
| | | Machine learning/deep learning |
| | Data engineering | Data utilization infrastructure design |
| | | Data utilization infrastructure implementation/operation |

| Category | Subcategory | Skills |
|---|---|---|
| Technology | Software development | Computer science |
| | | Team development |
| | | Software design methods |
| | | Software development processes |
| | | Web application fundamental technology |
| | | Frontend system development |
| | | Backend system development |
| | | Utilization of cloud infrastructure |
| | | SRE processes |
| | | Service utilization |
| | Digital technology | Physical computing |
| | | Other cutting-edge technology |
| | | Technology trends |
| Security | Security management | Security organization establishment and operation |
| | | Security management |
| | | Incident response and business continuity |
| | | Privacy protection |
| | Security technology | Secure design, development and implementation |
| | | Security operation, maintenance and monitoring |
| Personal skills | Human skills | Leadership |
| | | Collaboration |
| | Conceptual skills | Goal setting |
| | | Creative problem solving |
| | | Critical thinking |
| | | Adaptability |

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# Business Transformation | Strategy/Management/Systems

| Category | Subcategory | Skills | Contents (explanation of each type of skills) | Learning subject examples |
|---|---|---|---|---|
| Business transformation | Strategy/ management / systems | Business strategy formulation and execution | • Skills to formulate a business strategy, including startups/ecosystem creation, and to carry out product (products and services) portfolio management | • Ecosystem & alliances (searching for other companies/individuals with the requisite capabilities, M&A, investment, contracts)<br>• Risk management (protection of intellectual property rights and other rights, compliance, business ethics)<br>• Portfolio management<br>• Sustainability |
| | | Product management | • Skills to define the value proposition of a product (products and services), and to plan and implement revenue-generating methods on the basis of value provision, the product itself, and associated processes | • Product management, definition, sharing and evolution of the product vision, product development team leader<br>• Integration of business, UX and technology from a product perspective<br>• Product family management<br>• Stakeholder management, including company management, financial affairs, legal affairs, marketing, customer support and sales |
| | | Transformation management | • Skills to identify areas that could be impediments to DX promotion (organizational systems, culture and climate, along with various systems, human resources and operational processes), and to devise measures to address them<br>• Skills to involve relevant parties in the organizational/operational aspects of transformation | • Organizational systems, organizational culture and climate, various systems, human resources, operational processes<br>• Stakeholder management |
| | | Systems engineering | • Skills to regard all kinds of things as groups of multiple mutually interacting elements (systems), and to create approaches for achieving total optimization, while taking into account diverse value spanning multiple specialist disciplines | • Systems, life cycles, processes<br>• Specific activities within the system life cycle process (Requirements analysis, architecting, implementation, integration, testing, operation, maintenance, disposal) |
| | | Enterprise architecture | • Skills to sort out the organization’s component elements including businesses and operations, data and IT systems, and to achieve total optimization by means of hierarchical structuring and standardization | • Business architecture, business management mechanisms (ERP, PLM, CRM, SCM, etc.)<br>• Data architecture, data governance<br>• IT system architecture |
| | | Project management | • Skills to repeatedly iterate within a very short period, and to respond to changes in the business environment and requirements<br>• Skills to execute a program including one or more projects as planned, to the given quality standard, budget and deadline | • PMBOK® Guide 7th Edition<br>• Tailoring, Agile/Waterfall<br>• Procurement management |

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# Business Transformation | Business Model/Process

| Category | Subcategory | Skills | Contents (explanation of each type of skills) | Learning subject examples |
|---|---|---|---|---|
| Business transformation | Business model/ process | Business survey | • Skills to understand megatrends of social challenges and business, the market size and growth potential of an industry, and success factors and growth challenges of a business, product, or operations | • Survey design, business framework (PEST, 3C, 5 Forces, SWOT, STP, 4P, value chain, etc.)<br>• Relevance between a business/operations and digital technology |
| | | Business model design | • Skills to formulate a purpose or vision for a product or service based on success factors and growth challenges<br>• Skills to sort out the cost structure and channels, then consider the revenue model, etc. and design a mechanism for generating revenue | • Business Model Canvas, revenue model (sellout, servitization, subscription, etc.) |
| | | Business analysis | • Skills to visualize the current status of and the future vision for the activities necessary for providing a product or service and to identify activities that are particularly important or that create values<br>• Skills to clarify the fields in which digitalization should be promoted toward realizing a future vision | • Framework for visualizing the activities necessary for providing a product or service (service blueprint, value chain analysis, business process analysis, stakeholder map, service ecosystem map), requirement definition (business process relationship diagram, work flow diagram, etc.) |
| | | Verification (business perspective) | • Skills to verify how sustainable a product or service the company has developed is as a business (how much revenue can be expected, whether a competitive advantage can be gained, and how much cost can be reduced) | • Design and implementation of a verification approach based on the value proposition<br>• Setting of key performance indicators (KPIs) for monitoring |
| | | Marketing | • Skills to clarify the attributes of the company's customers, clarify the market needs and the values of the product the company provides and differentiate the product, and create, implement, and continue to improve the mechanism for delivering values to appropriate customers by an appropriate method and generating revenue | • Customer development, benefits and differentiation, web marketing, search engine optimization (SEO), social media marketing, customer support, AI-applied marketing |
| | | Branding | • Skills to formulate and implement a strategy for enhancing customer loyalty and differentiating the company's brand | • Brand proposition, brand identity |

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# Business Transformation | Design

| Category | Subcategory | Skills | Contents (explanation of each type of skills) | Learning subject examples |
|---|---|---|---|---|
| Business transformation | Design | Customer/user understanding | • Skills to design and conduct user research (research and interviews concerning customer satisfaction/usage data, etc.) and market/competitive research<br>• Skills to ascertain/analyze customer expectations and dissatisfaction, new needs and competition, and trends from the results of user research, and to derive insights from these | • Interview design, workshop design<br>• User research (A/B testing, card sorting, diary surveys, focus groups, etc.), market/competitive research (quantitative/qualitative)<br>• Analysis of research results, interactive design<br>• Persona and journey maps |
| | | Value discovery/ definition | • Skills to diverge ideas on the basis of customer/user needs while facilitating stakeholders, and to define the value proposition | • Frameworks in value discovery (service blueprints, assumption matrices, etc.)<br>• Ideation techniques (brainstorming, KJ method, scenario method, paper prototyping)<br>• Value proposition<br>• Formulation of product/service policies (concepts) |
| | | Design | • Skills to clarify the requisite functions and content in light of customer/user needs<br>• Skills to design function/content structures and frameworks with consideration for ease of understanding and finding on the part of customers/users<br>• Skills to design a look and feel that appeals to users | • Prototyping<br>• Information design, content design, accessibility/usability design, UI design (wireframes, mockups, object orientation/task orientation, etc.)<br>• Design systems (size, font, components, color, etc.)<br>• Design based on human behavioral principles and psychology<br>• Checks of finished products and services from an ethical perspective |
| | | Verification (customer/user perspective) | • Skills to verify whether the customer can actually experience the defined value proposition through the implemented product or service, and whether it is a useful experience for the customer | • Concept testing<br>• Usability evaluation planning and implementation |
| | | Other design technology | • Skills to design digital media graphics associated with marketing<br>• Skills to lay out and arrange pages of e-books, catalogues and the like in a manner that is easy to read | • Formulating branding policies (concepts) (mood boards, branding policies, etc.)<br>• Production of graphic design, 3D design, illustrations, etc.<br>• Editing, content planning, video production, UX writing<br>• Direction of photography/art, etc. |

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# Data Utilization

| Category | Subcategory | Skill | Content (explanation of the skill) | Learning subject examples |
|---|---|---|---|---|
| Data utilization | Strategic utilization of data/AI | Data understanding/ utilization | • Skills to accurately understand the results of data analysis that applies graphs, diagrams and other statistical information, along with various analytical techniques, and to gain deep insights into the meaning and background thereof | • Data understanding (understanding from a business viewpoint, extraction of meaning/insights)<br>• Data understanding/verification (accurate understanding of statistical information, high level overview/meta thinking, data understanding, data granularity) |
| | | Data/AI utilization strategy | • Skills to propose problem solving methods and new business models that utilize data/AI technologies, in light of business strategy, organizational challenges, customer needs and the like | • Ideas/design (ideas, design, consideration of AI utilization, decisions on disclosure/nondisclosure)<br>• Definition of challenges (KPIs, scoping, value estimation) |
| | | Design, implementation, and evaluation of operations that utilize data/AI | • Skills to design an approach aimed at achieving the goals of the data/AI strategy, and then to implement and continuously improve data/AI analysis mechanisms on the front line | • Approach design (data acquisition, AI-ready, approach design, analysis approach design, generative AI utilization)<br>• Analytical evaluation (evaluation, feedback into operations)<br>• Implementation in business (implementation, evaluation/improvement mechanisms)<br>• Project management (project launch, project planning, operation, horizontal deployment, policy change, completion, resource management, risk management) |
| | AI/data science | Mathematical statistics/multivariate analysis/data visualization | • Skills to use techniques based on statistical knowledge to analyze data and gain insights from the results | • Basic mathematics (basics of linear algebra, basics of differentials and integrals, basics of set theory)<br>• Basics of scientific analysis (basics of statistical mathematics, insights, identification of properties/relationships, estimation/testing, association analysis, causal inference)<br>• Data preparation (sampling, data cleansing, data processing, feature engineering)<br>• Data visualization (definition of direction, axis selection, data processing, expression/implementation techniques, extraction of meaning)<br>• Regression/classification, statistical evaluation, time series analysis<br>• Clustering, graphical models, network analysis<br>• Anomaly detection, recommendations<br>• Operations research (simulation, data assimilation, optimization) |
| | | Machine learning/deep learning | • Skills to create and evaluate appropriate models by using techniques including, machine learning, deep learning, natural language processing, image recognition, speech recognition and the like | • Machine learning, deep learning, reinforcement learning<br>• Unstructured data processing (natural language processing, image recognition, video recognition, speech recognition)<br>• Large language model, image generation model, audio generation model |

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# Data Utilization

| Category | Subcategory | Skill | Content (explanation of the skill) | Learning subject examples |
|---|---|---|---|---|
| Data utilization | Data engineering | Data utilization infrastructure design | • Skills to finalize the requisite system environment and requirements for collected data and tables, etc. in preparing data utilization infrastructure that generates output from data | • Environment creation (system planning, system design, architecture design)<br>• Data collection (client technology, communications technology, data extraction, data collection, data integration)<br>• Data structure (basic knowledge, requirement definition, table definition, table design) |
| | | Data utilization infrastructure implementation/ operation | • Skills to implement data utilization infrastructure that generates output from data, and to handle the data required to smoothly and effectively operate the infrastructure | • Data storage (DWH, distributed technology, cloud, real-time processing, cache technology, data storage technology, search technology)<br>• Data processing (filtering, sorting, joining, preprocessing, mapping, sampling, aggregation, conversion/computation)<br>• Data sharing (data output, data decompression, data linkage)<br>• Programming (basic programming, extension programming, AI service utilization, algorithms, analysis programs, SQL)<br>• AI system operation (source management, AutoML, MLOps, AIOps)<br>• Generative AI (prompt engineering, coding support, fine tuning, technical utilization of generative AI, generative AI development) |

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# Technology

SPA･･･Single Page Application IaC･･･Infrastructure as Code
CMS･･･Content Management Systems CDN･･･Content Delivery Systems
PWA･･･Progressive Web Apps

| Category | Subcategory | Skills | Contents (explanation of each type of skills) | Learning subject examples |
|---|---|---|---|---|
| Technology | Software development | Computer science | • Skills related to data structure and algorithms, etc. required in software development | • Software engineering, optimization, data structure, algorithms, theory of computation |
| | | Team development | • Skills required to increase the productivity of team-based software development | • Git/Git workflows, team building, leadable code, technical writing |
| | | Software design methods | • Skills to consider data structure and internal architecture in order to implement software in accordance with the objectives, and to apply these to the design | • Requirement definition techniques, domain-driven design, software design principles (SOLID), clean architecture, design patterns, non-functional requirement definitions |
| | | Software development processes | • Skills to manage development plans, quality and other such matters in software development | • Software development management (CCPM, agile development techniques, software estimation), test driven development (TDD), software quality control, OSS license management |
| | | Web application fundamental technology | • Basic skills required to design and develop web applications | • HTML/CSS, JavaScript, REST, WebSocket, SPA, CMS |
| | | Frontend system development | • Skills to design and develop screens that serve as the direct interface for users | • UI design, responsive design, mockup design, frontend frameworks, PWA, search optimization/SEO |
| | | Backend system development | • Skills to design and develop server-side functions that are not visible to users | • Database design, object storage, NoSQL, backend frameworks, cache, load balancing, authentication and authorization |
| | | Utilization of cloud infrastructure | • Skills to create and operate system infrastructure by using cloud services | • Cloud infrastructure (PaaS/IaaS), microservices, serverless, container technology, IaC, CDN |
| | | SRE processes | • Skills to aim for cooperation between development and operation in order to achieve improved release cycles and service stability | • Observability, OpenTelemetry, four keys, chaos engineering, CI/CD & DevOps |
| | | Service utilization | • Skills to carry out data linkage and system linkage to other internal systems, including core systems, and to external services | • API management, data linkage (iPaaS, ETL, EAI), RPA, low-code/no-code |
| | Digital technology | Physical computing | • Skills to digitalize and handle physical phenomena by using sensors, robots and IoT conversion of existing devices | • Edge computing, IoT cloud, LPWA, IoT sensors, wearables, robotics, drones, SBCs (Arduino, RaspberryPi, etc.), IoT gateways, recognition technologies (image, voice, etc.), 3D sensing, 3D printers, location measurement |
| | | Other cutting-edge technology | • Knowledge concerning implementation technologies other than those listed above and implementation technologies with few examples of application | *Study cutting-edge technologies as needed, such as the following examples:<br>• WebAssembly, HTTP/3, blockchain infrastructure, secure computation, Trusted Web, quantum computing, HITL: Human-in-the-Loop |
| | | Technology trends | • Knowledge concerning businesses and services that apply new digital technologies | *Study cutting-edge technologies as needed, such as the following examples:<br>• Generative AI, Metaverse, smart contracts, digital currencies, informatics (fields including materials, bioscience and measurement), GX (carbon tracing, etc.) |

# Security

| Category | Subcategory | Skills | Contents (explanation of each type of skills) | Learning subject examples |
|---|---|---|---|---|
| Security | Security management | Security organization establishment and operation | • Skills to establish organizations for implementing security measures and to facilitate their maintenance and operation (including securing and cultivating key personnel)<br>• Skills to undertake activities that foster an organization-wide security culture within the company | • Procedures for collaborating with security response organizations (security management functions, SOC, xSIRT, etc.)<br>• Clarification of roles and responsibilities within the organization that relate to service and device security measures<br>• Methods of fostering a security culture within the organization |
| | | Security management | • Skills to appropriately implement on an organization-wide basis security management processes relating to such matters as information, cyber space and OT/IoT environments | • Security-related legal system<br>• Development of policies, regulations, manuals and the like<br>• Awareness of risks, including the utilization of threat intelligence<br>• Risk assessment techniques<br>• Definition of security requirements, security functions as functional requirements<br>• Authentication method types, features and selection methods<br>• Information asset management, configuration management<br>• Security education/training and qualification/certification systems<br>• Information security audit techniques |
| | | Incident response and business continuity | • Skills to minimize impacts and enable business continuity in the event that risks (cyber attacks, loss, internal misconduct, disaster, failure, etc.) become actualized as security incidents in the course of digital usage | • Business continuity in digital usage<br>• Business continuity plan development and drills<br>• Procedures for coordinating incident response and crisis management<br>• Information sharing and communication under routine circumstances and in an emergency |
| | | Privacy protection | • Skills to understand requirements for the protection of personal data and other privacy-related information and to put them into practice | • Legal system related to privacy protection<br>• Consideration of management systems related to privacy protection in light of the nature of the business<br>• Privacy impact assessment (PIA) overview and procedures<br>• Privacy-related risks and measures in handling data |
| | Security technology | Secure design, development and implementation | • Skills to carry out design, development and implementation on the basis of the standards and requirements that should be complied with in order to make the organization less susceptible to cyber attacks or misconduct of various kinds when planning and designing digital services and products<br>• Skills to understand the vulnerabilities of digital services and products and to appropriately conduct diagnosis in practice (including by means of outsourcing) | • Secure system design overview and practice method<br>• DevSecOps mindset and practice<br>• Achievement and implementation of security requirements and security functions<br>• Security measures in IT/OT/IoT devices<br>• Security function overview and settings for cloud services and network devices<br>• Vulnerability concepts, measures and diagnostic methods |
| | | Security operation, maintenance and monitoring | • Skills to appropriately practice maintenance and measures in order to securely operate digital services<br>• Skills to appropriately practice such tasks as security monitoring and investigation of the causes of security incidents | • Utilization of threat information and vulnerability information<br>• Monitoring methods and utilization of observation data<br>• Application of AI to operation and monitoring work<br>• Impact investigation and triage methods in the event of an incident<br>• Utilization of digital forensic investigation services |

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# Personal skills

| Category | Subcategory | Skills | Contents (explanation of each type of skills) | Learning subject examples |
|---|---|---|---|---|
| Personal skills | Human skills | Leadership | • Skills to create teams in which a variety of relevant parties, both internal and external, can readily participate by means of the communication of an impression of the goal to be achieved and the creation of win-win relationships<br>• Skills to flesh out the tasks required and to encourage the execution of tasks in a manner that takes into account the respective strengths and interests of the relevant parties | • Team building, inclusive communication, D&I, empowerment, stakeholder management |
| | | Collaboration | • Skills to form a consensus with people who have diverse values, including customers and users, and to work toward a goal, by making a point of eliciting conflicting views and contradictions, and exploring the issues in greater depth | • Facilitation (listening and asking questions, framing of issues), psychological safety, types of organizations/teams |
| | Conceptual skills | Goal setting | • Skills to imagine the future by highlighting problems from various viewpoints, and to set objectives for initiatives and goals that serve as the final end point of those objectives<br>• Skills to create stories that appeal not only to rational judgment, but also to emotion and unconscious psychological reactions, and to depict an impression of the goal once achieved in the form of a vision | • Future thinking<br>• Storytelling, visionary leadership |
| | | Creative problem solving | • Skills to creatively solve problems by restructuring unprecedented experimental/innovative ideas and the views of users/relevant parties, while taking into account multiple areas of expertise and social/customer trends | • Design thinking, horizontal thinking, hypothetical thinking, fail fast |
| | | Critical thinking | • Skills to evaluate the information obtained without accepting it unquestioningly, and to engage in thinking after a rational process based on trustworthy information | • Critical thinking/logical thinking, systems thinking |
| | | Adaptability | • Skills to reflect feedback and undertake continuous improvement, while adapting to change and operating a short span cycle<br>• Skills to identify newly required skills and engage in learning throughout one's life (*including not only digital solutions, but also such areas as business plans and concept charts) | • Agility, OODA loop, lean thinking |

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# Approach to Skill Mapping

- The skill level required for each of the skills required in each role is defined on the basis of the level of importance shown below, with reference to the skills set out in the List of Common Skills.

## Approach to assigning importance (business transformation / data utilization / technology / security)

- **Skills in technological aspects** required for the execution of operations in DX promotion are assigned importance on the basis of the following criteria:

| Criteria | Definition |
|---|---|
| a | High level of practical ability and expertise required |
| b | A certain level of practical ability and expertise required |
| c | Ability to provide a knowledge-based explanation required |
| d | Understanding of positioning within the overall system and relevance to other items required |

## Approach to assigning importance (personal skills)

- The importance of **skills in personal aspects** required for the execution of operations in DX promotion is defined on the basis of the following criteria:

| Criteria | Definition |
|---|---|
| z | Practical ability corresponding to role and situation is required<br>*Skills universally required in all DX promotion roles |

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# Chapter 3

# Human Resource Types & Roles

a. Business Architects

b. Designers

c. Data Scientists

d. Software Engineers

e. Cyber Security

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# What Are Business Architects?

**Definition**

**Human resources who, in DX initiatives (new business development / upgrading of existing business / upgrading and streamlining of internal operations), define what is to be achieved through transformation in business and work (i.e. goals), and then achieve these goals by coordinating the relevant parties and taking a lead role in building collaborative relationships among them while moving processes forward in a consistent manner towards the goals**

## ◆ Reason for choosing “business architect”

- ✓ There is a tendency to think of human resources who promote DX as being human resources who have specialist knowledge and skills relating to data and digital technology. While such human resources are, of course, important, **this type was defined on the basis of the thinking that human resources who take the lead in bringing to fruition the transformation of the business itself**—the process beyond the utilization of data and digital technology—**are required**.
- ✓ This type encompasses human resources who take responsibility for setting and achieving new goals; **in order to achieve new goals, it is necessary to use various means (such as business models*1, business processes*2 and IT) to design mechanisms—that is to say, “architecture.” As the principal areas on which design by this type is expected to focus are business models and business processes, the name “business architect” was chosen** to describe human resources who primarily design architecture relating to business.

*1 Business model: Value proposition, method of achieving the value proposition, revenue generation method (business model, operating model, etc.)

*2 Business process: How people, goods, money and information should move in order to implement the business model

## ◆ Themes of DX initiatives

- ✓ The settings in which business architects play a part **focus solely on initiatives that utilize individual datasets or digital technologies (envisaged on the basis of individual products, services and operations)**, and exclude initiatives that relate to the enhancement of organizational capabilities (creation of companywide organizations and human resource development for the purpose of DX promotion)
  - This is because the human resources envisaged in the DSS-P **are not expected to be at a management level at which they hold responsibility for companywide initiatives**
  - However, the skill of highlighting to management problems concerning companywide organizational capabilities in the course of undertaking DX promotion initiatives is defined as a skill that the business architect type should have
- ✓ Individual initiatives are classified as business or operations, depending on the destination to which the products and services are provided (external or internal). Business initiatives are further divided on the basis of novelty into new and existing, as the matters to consider and content of work is likely to differ.
  - **New business development:** Provision to the market of new products and services by using data and digital technology
  - **Upgrading of existing business:** Improvement of the value of existing products and services by using data and digital technology (diverse methods of provision, development of new markets for existing products, etc.)
  - **Upgrading and streamlining of internal operations:** Improvement of the quality, cost and speed of internal operations by using data and digital technology

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# What Are Business Architects? | Expected Roles (1/2)

- The specific roles expected of a business architect and actions required of them are as follows:

### ◆ Taking of responsibility for the design of digital businesses and the implementation of the designed business through the promotion of initiatives in a consistent manner

- ✓ In DX initiatives, it is crucial to establish the goal of the initiative (e.g. the vision for what the new business seeks to achieve), and to consistently promote processes to achieve that goal (establishment of the business model and business processes, selection of technologies and tools, verification of hypothesis and verification of effects after introduction).
  Business architects are required to **consistently promote** these processes and **to take responsibility for the achievement of the goals initially set**.
- ✓ While business models and business processes are the primary focus of design by business architects, they are also required to **collaborate as needed with human resources who have specialist technological skills and knowledge**, in the design of a wide range of other technological aspects (including data structure definitions, surveys of trends in technologies and techniques/tools, definition/design of applications that ensure the consistency of business and IT, definition of IT infrastructure and definition of security policies and models).

### ◆ Coordination of relevant parties and leadership of efforts to establish collaborative relationships among relevant parties

- ✓ In DX initiatives, it is crucial for all relevant parties to demonstrate leadership in their own specialist disciplines. Business architects are required to **coordinate relevant parties and lead efforts to establish collaborative relationships among relevant parties,** in order to achieve the goal of the initiative
- ✓ In coordinating relevant parties, business architects are required to secure the requisite resources, form teams, allocate tasks in an unbiased way with an awareness of ensuring the right resource in the right place and encourage consensus-building among relevant parties, among other tasks.

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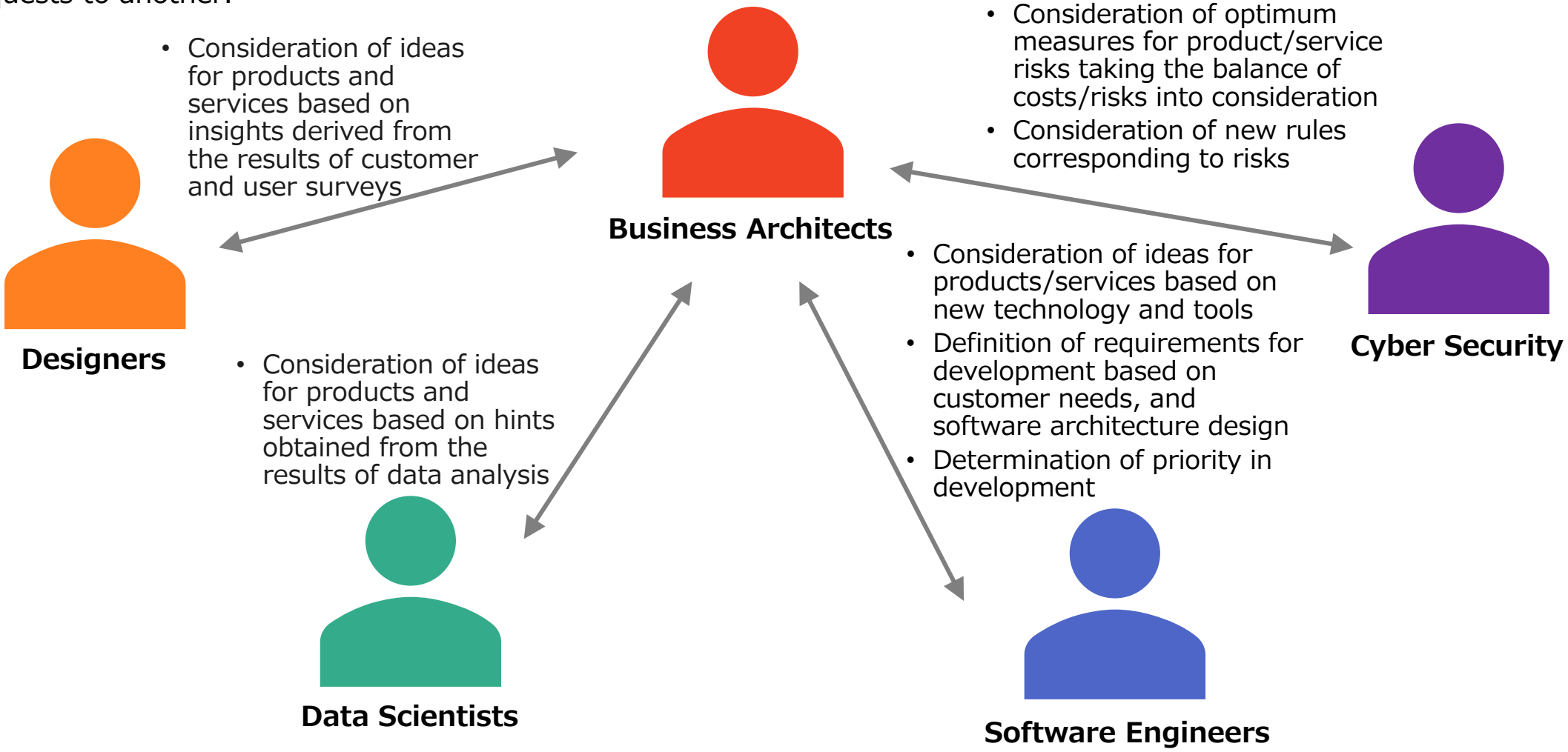
# What Are Business Architects? | Expected Roles (2/2)

- The following shows an example of an operation in which a business architect collaborates with the other human resource types.
- The two-way arrows represent the relationships between each type, to indicate that two or more human resource types build collaborative working relationships in a range of situations, rather than being a situation in which one type issues instructions or requests to another.

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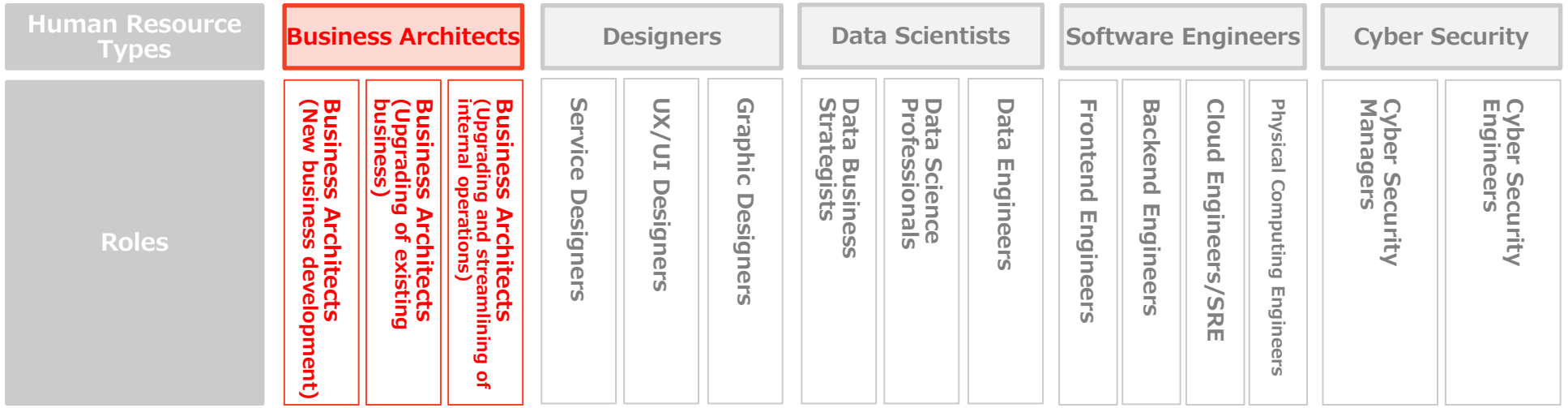
# Roles of Business Architects




## ◆ Roles categorized on the basis of the themes addressed

- ✓ The business architect type is categorized into a number of roles on the basis of differences in the work carried out.
- ✓ As business architects are required to consistently promote DX initiatives from the goal-setting stage through to introduction, and beyond to verification of effects after introduction, as well as to hold responsibility for the achievement of the goals, the type has been broken down into three roles on the basis of three themes of such initiatives (new business development, upgrading of existing business and upgrading and streamlining of internal operations), rather than processes involved in carrying out DX initiatives (e.g. taking responsibility for the vision or for implementation).
- ✓ Based on its definition, DX refers to the transformation of products, services and business models by utilizing data and digital technology, but at the same time, it could be hard for companies about to embark on DX promotion to form an impression of what that looks like. Accordingly, themes that are comparatively easy for such companies to visualize as the first areas on which to set to work have also been included in the themes addressed by business architects, namely upgrading of existing business and upgrading and streamlining of internal operations.
- ✓ The ways in which business architects handle the roles set out here in the course of promoting a company's DX will vary. **It is also envisaged that several people might handle a single role, or that one person might handle several roles**, depending on the size of the company or the scale of the themes being addressed.

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# Roles of Business Architects | Approach to Skill Mapping

## Business architect (new business development)

- ✓ **In skills associated with business transformation and data utilization, both knowledge and a high level of practical ability are required**
  - These are needed when defining the goal of a new product or service and designing the business model and business process for achieving that goal
- ✓ **With regard to skills associated with technology and security, too, business architects in this role need to have a certain level of knowledge required to coordinate relevant parties**
  - These are needed when designing a wide range of technological aspects other than business models and business processes (including data structure definitions, surveys of trends in technologies and techniques/tools, definition/design of applications that ensure the consistency of business and IT, definition of IT infrastructure and definition of security policies and models)

## Business architect (upgrading of existing business)

- ✓ Similarly to the “business architect (new business development)” role, **business architects in this role require both knowledge and a high level of practical ability in skills associated with business transformation and data utilization, and also need a certain level of knowledge required to coordinate relevant parties with regard to skills associated with technology and security, too**
- ✓ In the upgrading of existing business, the settings where skills are practiced or demonstrated are likely to differ from new business development, as are their respective degrees of difficulty, but there is thought to be no difference in the actual skills required, so it was decided that the upgrading of existing business required the same skills as new business development
  - New business development has a higher degree of difficulty than upgrading of existing business, as the former is defined as seeking to achieve something new from nothing through business transformation. On the other hand, however, upgrading of existing business is thought to have a higher degree of difficulty than new business development in that it requires scaling up while coordinating with stakeholders and ensuring compatibility with the requirements of existing products and services

## Business architect (upgrading and streamlining of internal operations)

- ✓ As the scope of the theme addressed is internal operations, the level of practical ability required in this role when it comes to business transformation and strategic utilization of data/AI is not as high as for new business development or the upgrading of existing business, but **a high level of practical ability is required in relation to transformation management**, which involves numerous stakeholders
  - This is needed when coordinating relevant parties (securing the requisite resources, forming teams and allocating tasks in an unbiased way with an awareness of ensuring the right resource in the right place)

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# Roles of Business Architects | Responsibilities/Main Work & Skills (1/3)

**Human Resource Type**

Business Architect

**Role**

## Business architect (new business development)

**Responsibilities in DX Promotion**

Identify the goals of new business and products and services, set out the method for achieving the newly defined goals, and then achieve these goals by coordinating the relevant parties and taking a lead role in building collaborative relationships among them while moving processes forward in a consistent manner towards the goals

**Main Work**

- Define the goal of a new business, product or service in light of the company's internal or external environment, or the needs of society or customers/users; design the business model and business process for achieving that goal; and select the technologies and techniques/tools to be utilized in doing so
- Verify the feasibility of the new product/service and the effectiveness of the solution to be used, then formulate a business plan aimed at launching the product/service and take responsibility for everything from refining the requirements of the solution to bringing it to fruition
- Through customer/user feedback and KPI monitoring, undertake ongoing consideration/implementation of processes, along with measures to improve the profitability of the solution (such as the expansion of target customers/users and fields)
- Coordinate all relevant parties consistently from planning through to verification of the effects of the new product/service (including securing the requisite resources, forming teams, allocating tasks in an unbiased way with an awareness of ensuring the right resource in the right place and encouraging consensus-building among relevant parties)

**Required Skills**

| Category | Subcategory | Skills | Importance |
|---|---|---|---|
| Business transformation | Strategy/ management/ systems | Business strategy formulation and execution | a |
| | | Product management | a |
| | | Transformation management | a |
| | | Systems engineering | a |
| | | Enterprise architecture | a |
| | | Project management | b |
| | Business model/ processes | Business surveys | a |
| | | Business model design | a |
| | | Business analysis | a |
| | | Verification (business perspective) | a |
| | | Marketing | b |
| | | Branding | b |
| | Design | Customer/user understanding | b |
| | | Value discovery/definition | b |
| | | Design | d |
| | | Verification (customer/user perspective) | c |
| | | Other design technology | d |

| Category | Subcategory | Skills | Importance |
|---|---|---|---|
| Data utilization | Strategic utilization of data/AI | Data understanding/utilization | b |
| | | Data/AI utilization strategy | b |
| | | Design, implementation and evaluation of operations that utilize data/AI | c |
| | AI/data science | Mathematical statistics/multivariate analysis/data visualization | d |
| | | Machine learning/deep learning | d |
| | Data engineering | Data utilization infrastructure design | d |
| | | Data utilization infrastructure implementation/operation | d |
| Technology | Software development | Computer science | d |
| | | Team development | d |
| | | Software design methods | d |
| | | Software development processes | c |
| | | Web application fundamental technology | d |
| | | Frontend system development | d |
| | | Backend system development | d |
| | | Utilization of cloud infrastructure | d |
| | | SRE processes | d |
| | | Service utilization | d |

| Category | Subcategory | Skills | Importance |
|---|---|---|---|
| Technology | Digital technology | Physical computing | c |
| | | Other cutting-edge technology | d |
| | | Technology trends | c |
| Security | Security management | Security organization establishment and operation | d |
| | | Security management | c |
| | | Incident response and business continuity | c |
| | | Privacy protection | b |
| | Security technology | Secure design, development and implementation | d |
| | | Security operation, maintenance and monitoring | d |
| Personal skills | Human skills | Leadership | z |
| | | Collaboration | z |
| | Conceptual skills | Goal setting | z |
| | | Creative problem solving | z |
| | | Critical thinking | z |
| | | Adaptability | z |

[Importance key]
a High level of practical ability and expertise required
b A certain level of practical ability and expertise required
c Ability to provide an explanation required
d Understanding of positioning and relevance required
z Practical ability corresponding to role and situation is required

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# Roles of Business Architects | Responsibilities/Main Work & Skills (2/3)

| | |
|---|---|
| **Human Resource Type** | Business Architect |
| **Role** | **Business architect (upgrading of existing business)** |
| **Responsibilities in DX Promotion** | Rethink the goals of existing business and products and services, set out the method for achieving the redefined goals, and then achieve these goals by coordinating the relevant parties and taking a lead role in building collaborative relationships among them while moving processes forward in a consistent manner towards the goals |
| **Main Work** | • Redefine the goal of an existing business, product or service in light of the company's internal or external environment, or the needs of society or customers/users; design the business process for achieving that goal; and select the technologies and techniques/tools to be utilized in doing so<br>• Verify the feasibility of the existing product/service and the effectiveness of the solution to be used, then revise the existing business plan and take responsibility for everything from refining the requirements of the solution to bringing it to fruition<br>• Through customer/user feedback and KPI monitoring, undertake ongoing consideration/implementation of processes, along with measures to improve the profitability of the solution (such as the expansion of target customers/users and fields)<br>• Coordinate all relevant parties consistently from planning through to verification of effects (including securing the requisite resources, forming teams, allocating tasks in an unbiased way with an awareness of ensuring the right resource in the right place and encouraging consensus-building among relevant parties) |

**Required Skills**

| Category | Subcategory | Skills | Importance |
|---|---|---|---|
| Business transformation | Strategy/ management/ systems | Business strategy formulation and execution | a |
| | | Product management | a |
| | | Transformation management | a |
| | | Systems engineering | a |
| | | Enterprise architecture | a |
| | | Project management | b |
| | Business model/ processes | Business surveys | a |
| | | Business model design | a |
| | | Business analysis | a |
| | | Verification (business perspective) | a |
| | | Marketing | b |
| | | Branding | b |
| | Design | Customer/user understanding | b |
| | | Value discovery/definition | b |
| | | Design | d |
| | | Verification (customer/user perspective) | c |
| | | Other design technology | d |
| Data utilization | Strategic utilization of data/AI | Data understanding/utilization | b |
| | | Data/AI utilization strategy | b |
| | | Design, implementation and evaluation of operations that utilize data/AI | c |
| | AI/data science | Mathematical statistics/multivariate analysis/data visualization | d |
| | | Machine learning/deep learning | d |
| | Data engineering | Data utilization infrastructure design | d |
| | | Data utilization infrastructure implementation/operation | d |
| Technology | Software development | Computer science | d |
| | | Team development | d |
| | | Software design methods | d |
| | | Software development processes | c |
| | | Web application fundamental technology | d |
| | | Frontend system development | d |
| | | Backend system development | d |
| | | Utilization of cloud infrastructure | d |
| | | SRE processes | d |
| | | Service utilization | d |
| Technology | Digital technology | Physical computing | c |
| | | Other cutting-edge technology | d |
| | | Technology trends | c |
| Security | Security management | Security organization establishment and operation | d |
| | | Security management | c |
| | | Incident response and business continuity | c |
| | | Privacy protection | b |
| | Security technology | Secure design, development and implementation | d |
| | | Security operation, maintenance and monitoring | d |
| Personal skills | Human skills | Leadership | z |
| | | Collaboration | z |
| | Conceptual skills | Goal setting | z |
| | | Creative problem solving | z |
| | | Critical thinking | z |
| | | Adaptability | z |

[Importance key]
a High level of practical ability and expertise required
b A certain level of practical ability and expertise required
c Ability to provide an explanation required
d Understanding of positioning and relevance required
z Practical ability corresponding to role and situation is required

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# Roles of Business Architects | Responsibilities/Main Work & Skills (3/3)

**Human Resource Type**

Business Architect

**Role**

## Business architect (upgrading and streamlining of internal operations)

**Responsibilities in DX Promotion**

Define goals for problem solving in internal operations and set out the method for achieving these goals, and then achieve these goals by coordinating the relevant parties and taking a lead role in building collaborative relationships among them while moving processes forward in a consistent manner towards the goals

**Main Work**

- Define challenges and goals for problem solving in internal operations, design new operational processes that utilize data and digital technology, and select the technologies and techniques/tools for implementing those processes
- Verify the feasibility of new operational processes, the advisability of problem solving using the new processes and the effectiveness of the solution; formulate plans, define solution requirements, and undertake implementation
- Through customer/user feedback and KPI monitoring, undertake ongoing consideration/implementation of processes, along with measures to improve the profitability of the solution and processes (such as reducing costs)
- Coordinate all relevant parties consistently from planning through to verification of effects (including securing the requisite resources, forming teams, allocating tasks in an unbiased way with an awareness of ensuring the right resource in the right place and encouraging consensus-building among relevant parties)

**Required Skills**

| Category | Subcategory | Skills | Importance |
|---|---|---|---|
| Business transformation | Strategy/ management/ systems | Business strategy formulation and execution | d |
| | | Product management | d |
| | | Transformation management | a |
| | | Systems engineering | c |
| | | Enterprise architecture | c |
| | | Project management | b |
| | Business model/ processes | Business surveys | c |
| | | Business model design | d |
| | | Business analysis | c |
| | | Verification (business perspective) | c |
| | | Marketing | d |
| | | Branding | d |
| | Design | Customer/user understanding | c |
| | | Value discovery/definition | c |
| | | Design | d |
| | | Verification (customer/user perspective) | c |
| | | Other design technology | d |

| Category | Subcategory | Skills | Importance |
|---|---|---|---|
| Data utilization | Strategic utilization of data/AI | Data understanding/utilization | b |
| | | Data/AI utilization strategy | c |
| | | Design, implementation and evaluation of operations that utilize data/AI | c |
| | AI/data science | Mathematical statistics/multivariate analysis/data visualization | d |
| | | Machine learning/deep learning | d |
| | Data engineering | Data utilization infrastructure design | d |
| | | Data utilization infrastructure implementation/operation | d |
| Technology | Software development | Computer science | d |
| | | Team development | d |
| | | Software design methods | d |
| | | Software development processes | c |
| | | Web application fundamental technology | d |
| | | Frontend system development | d |
| | | Backend system development | d |
| | | Utilization of cloud infrastructure | d |
| | | SRE processes | d |
| | | Service utilization | c |

| Category | Subcategory | Skills | Importance |
|---|---|---|---|
| Technology | Digital technology | Physical computing | c |
| | | Other cutting-edge technology | d |
| | | Technology trends | c |
| Security | Security management | Security organization establishment and operation | d |
| | | Security management | c |
| | | Incident response and business continuity | c |
| | | Privacy protection | b |
| | Security technology | Secure design, development and implementation | d |
| | | Security operation, maintenance and monitoring | d |
| Personal skills | Human skills | Leadership | z |
| | | Collaboration | z |
| | Conceptual skills | Goal setting | z |
| | | Creative problem solving | z |
| | | Critical thinking | z |
| | | Adaptability | z |

[Importance key]
a High level of practical ability and expertise required
b A certain level of practical ability and expertise required
c Ability to provide an explanation required
d Understanding of positioning and relevance required
z Practical ability corresponding to role and situation is required

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# Supplementary Material | Themes of DX Initiatives (Overview)

- Specific examples of the three themes of DX initiatives (new business development, upgrading of existing business, and upgrading and streamlining of internal operations) are shown below

| Theme | | Content | Specific examples |
|---|---|---|---|
| Business (Customer-Facing) | New business development | Provision to the market of new products and services by using data and digital technology | (a) A printing company utilizes image processing know-how to provide an inspection automation support service for manufacturing industry (automatic identification of defective items from characteristics included in image data) |
| | | | (b) By collecting and analyzing customer sleep data, a bed manufacturer develops a technology that identifies signs of dementia by using a sensor mat, and expands into the field of preventive medicine |
| | | | (c) A taxi company provides a taxi dispatch platform (gaining a new source of revenue from platform usage fees by making it available to other companies and individual taxi operators, rather than keeping it closed for its own use) |
| | | | (d) A railway company provides a micromobility service |
| | | | (e) A beverage manufacturer provides a monitoring service for elderly people that utilizes IoT functions to detect coffee being made and notifies family members of whether or not coffee has been made |
| | | | (f) A startup company provides a sensor and app that can monitor and record kindergarten students (by using a sensor to monitor the child's sleep status and recording the position of their body, etc. in the app) |
| | | | (g) An event management company photographs participants and distributes the photographs via an app (for a fee) |
| | Upgrading of existing business | Improvement of the value of existing products and services by using data and digital technology (diverse methods of provision, development of new markets for existing products, etc.) | (h) A dispensing pharmacy provides an online pharmacy service (charging a delivery fee, but no usage fee) |
| | | | (i) A food manufacturer finds a market that likes a particular flavor, and distributes and markets the product with pinpoint accuracy (digital marketing) |
| | | | (j) A cosmetics company uses an app to diagnose the condition of a user's skin and recommend the most appropriate cosmetics |
| | | | (k) An agricultural machinery manufacturer equips agricultural machinery with IoT functions and provides users with recommendations for maintenance and after-sale parts on the basis of the operational status |
| Operations (Internal) | Upgrading and streamlining of internal operations | Improvement of the quality, cost and speed of internal operations by using data and digital technology | (l) Control of product costs and improvement of profitability by means of the adjustment of the factory production schedule and procurement of raw materials from suppliers on the basis of customer demand information obtained from a demand forecasting tool |
| | | | (m) In the manufacturing industry, visualization of operational status and achievement of efficient production line operation by means of the introduction of AI and equipment sensors (smart factory) |
| | | | (n) Automation of operations by using no-code/low-code tools |

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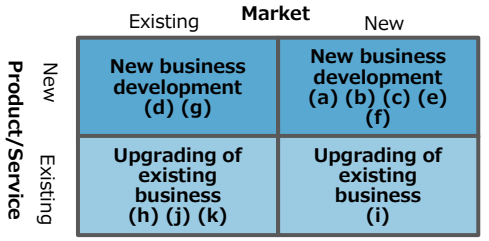
# Supplementary Material | Themes of DX Initiatives (Difference between New and Existing)




- New business and existing business are categorized on the basis of the **novelty of the product or service**[Note]
  ***Novelty: Novelty for the company or organization undertaking DX**
- If the product or service is new, it is defined as new business, regardless of the novelty of the market

| Theme | Content | Specific examples | | | | |
|---|---|---|---|---|---|---|
| | | CSR Initiatives | Change in product/service provided | | *Reference Change in market (main customer) | |
| | | | Before | After | Before | After |
| **New business development** | **Provision to the market of new products and services by using data and digital technology** | (a) A printing company utilizes image processing know-how to provide an inspection automation support service for manufacturing industry (automatic identification of defective items from characteristics included in image data) | Printed material | **Service to support the automation of product inspection** | People who order printed material | **Manufacturers** |
| | | (b) By collecting and analyzing customer sleep data, a bed manufacturer develops a technology that identifies signs of dementia by using a sensor mat, and expands into the field of preventive medicine | Beds | **Service to identify signs of dementia** | People who use beds | **Medical institutions/ nursing homes** |
| | | (c) A taxi company provides a taxi dispatch platform (gaining a new source of revenue from platform usage fees by making it available to other companies and individual taxi operators, rather than keeping it closed for its own use) | Taxi service | **Platform** | Taxi users | **Taxi companies/ advertisers** |
| | | (d) A railway company provides a micromobility service | Railway service | **Micromobility (and booking app)** | People who travel to the destination | People who travel to the destination |
| | | (e) A beverage manufacturer provides a monitoring service for elderly people that utilizes IoT functions to detect coffee being made and notifies family members of whether or not coffee has been made | Coffee manufacturer | **Monitoring service** | Coffee drinkers | **Families of elderly people** |
| | | (f) A startup company provides a sensor and app that can monitor and record kindergarten students (by using a sensor to monitor the child's sleep status and recording the position of their body, etc. in the app) | *No existing product, as it is a startup | **Monitoring sensor and recording app** | *No existing customer, as it is a startup | **Nursery** |
| | | (g) An event management company photographs participants and distributes the photographs via an app (for a fee) | Events | **Photograph distribution service** | Event participants | Event participants |
| **Upgrading of existing business** | **Improvement of the value of existing products and services by using data and digital technology (diverse methods of provision, development of new markets for existing products, etc.)** | (h) A dispensing pharmacy provides an online pharmacy service (charging a delivery fee, but no usage fee) | Medication | Medication | Patients | Patients |
| | | (i) A food manufacturer finds a market that likes a particular flavor, and distributes and markets the product with pinpoint accuracy (digital marketing) | Food product A | Food product A | People who like the food product regardless of flavor | **People who like a specific flavor** |
| | | (j) A cosmetics company uses an app to diagnose the condition of a user's skin and recommend the most appropriate cosmetics | Cosmetics | Cosmetics | Cosmetics users | Cosmetics users |
| | | (k) An agricultural machinery manufacturer equips agricultural machinery with IoT functions and provides users with recommendations for maintenance and after-sale parts on the basis of the operational status | Agricultural machinery | Agricultural machinery | Agricultural machinery users | Agricultural machinery users |

Note Product or service: Limited to things that earn remuneration from customers

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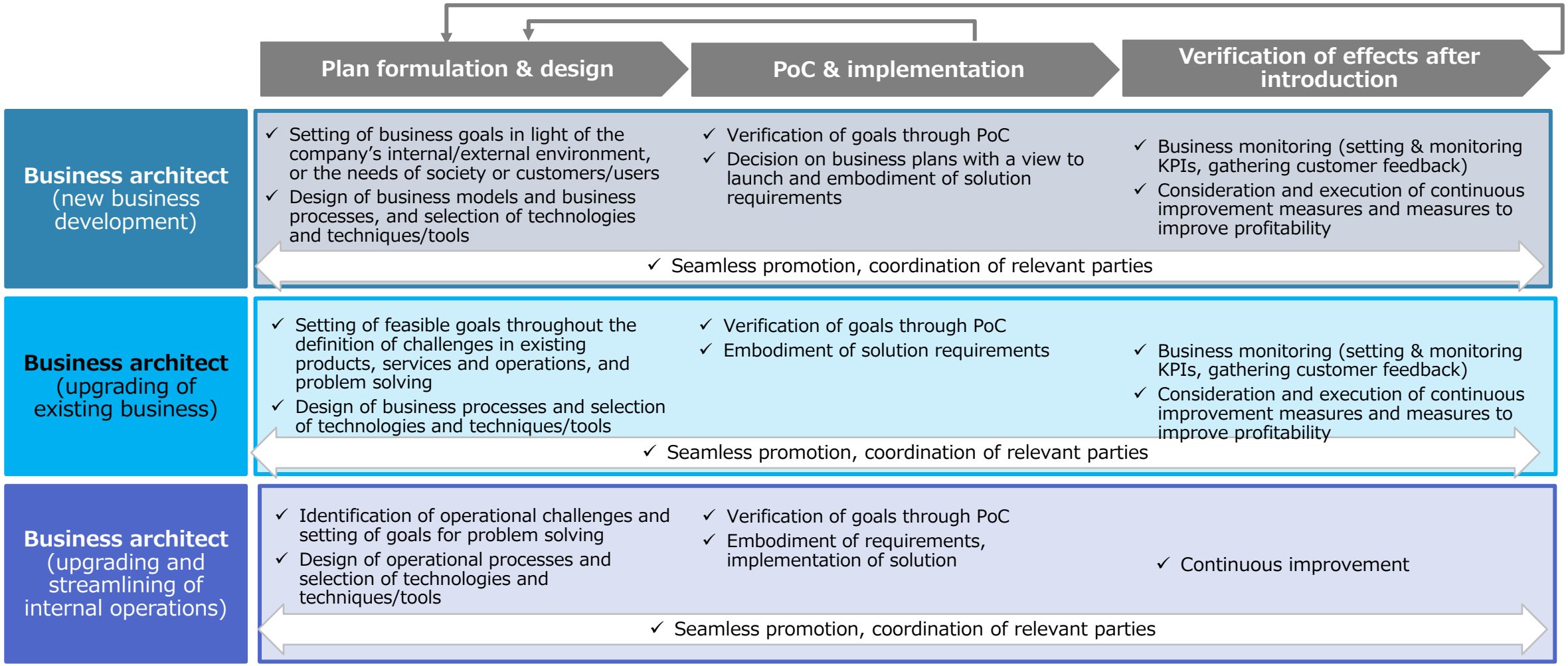
# Supplementary Material | How the Roles of Business Architects Are Divided Up

- The roles are divided up by DX initiative theme, on the basis of differences in the capabilities required




* The approach to the division of roles shown above is intended as a rough guide; in reality, approaches will vary from one company to another, as the question of who takes on what responsibilities will differ from one case to another

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# Supplementary information to Business Architects: Background/Premise of Definition of Product Manager, Expected Roles

- Product managers, which are becoming more common in Japan, are defined as one of the human resources who promote DX, and they are being added to this standard.

## ◆ Background/premise of why the product manager was added

- ✓ A product managers is positioned as a general type of job in global standards, and is also becoming more common at Japanese companies, especially those that provide digital services.
- ✓ In the above, **a product manager is defined as a job similar to a business architect.**
- ✓ In response to the above-mentioned circumstances, this revision **defines a product manager as one of the human resources who promotes DX, and adds supplementary information to the business architect type.**

## ◆ Expected roles

- ✓ The origin of the product manager is said to be a position established in certain companies whose mission was to improve the value of businesses, products, and services.
  It can be thought that the role of this position, which is to lead the parties involved in the process from formulating a concept to the release of products/services and subsequent improvements to improve the value of businesses, products, and services, is similar to that of product managers who promote DX.
- ✓ Based on the above, it can be said that product managers **have the following in common with business architects:**
  - **They both lead the parties involved to drive each step of a process to completion in order to achieve objectives**
  - **Concerning products (i.e., businesses, products, and services that utilize digital technology), they both promote efforts to achieve objectives by combining multiple products** instead of just one

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# Supplementary information to Business Architects: Responsibilities, Main Work, and Skills of a Product Manager

- The responsibilities, main work, and required skills of product managers who promote DX are defined as follows:

## ◆ Responsibilities for promoting DX

- ✓ Defines the objectives and overall picture of the state to achieve through business transformation and drives the process to achieve these goals to completion including the definition of a strategy to develop a product (i.e., business, product, or service that utilize digital technology), the release of the product, as well as subsequent improvements. Takes the lead in efforts such as engaging internal external stakeholders to continue improving the value of the product.

## ◆ Main work

- ✓ Defines the objectives and overall picture of the state to achieve through business transformation, and define a strategy to achieve these goals while giving consideration to factors such as internal and external environments, technological trends, and the needs of society, customers, and users
- ✓ Identifies how each step of the process (e.g., product development, product release, subsequent improvement) impact each other and determine policies to deal with potential problems in order to execute the strategy
- ✓ Enables continuous value improvement that goes beyond the current value of the product by improving products based on quality assessments and feedback from customers and users, in addition to maximizing revenue and user value through product positioning, analysis of customer and user needs, and planning of measures to improve profitability.
- ✓ Coordinates the parties involved throughout the entire process (e.g., strategy definition, development, release, subsequent improvement) through clear and persuasive communication, team building to improve performance, and the like.

## ◆ Required skills

- ✓ Since product mangers play similar roles to those of business architects in that both positions lead the parties involved to drive each step of a process to completion and promote efforts that combine multiple products, the skills required to fulfill their roles are also thought to be shared with those required for business architects.
- ✓ Based on the above, the skills required for product managers are defined to be the same as those required for business architects (developing new businesses and improving existing businesses).

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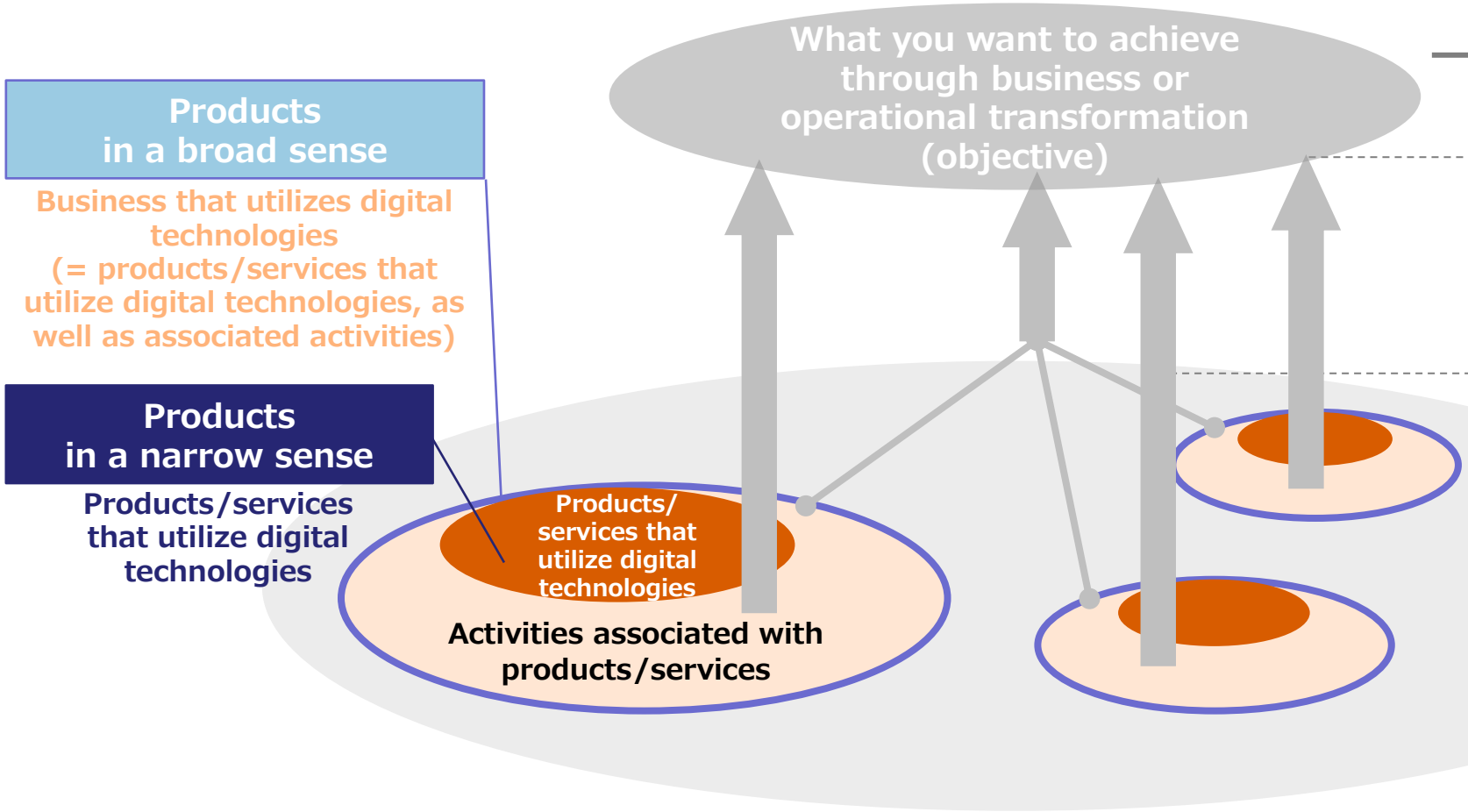
# Supplementary material | What Is a Product in the Digital Skill Standards?

- "Products" in the Digital Skill Standards not only refer to individual products and services ("products" in a narrow sense), but also include activities associated with them ("products" in a broad sense).




## Specific examples

**Objective**

■ Promote preventative medicine

**Initiatives that combine products in a broad sense**

■ Identification of risk of onset of disease

- ✓ Identification of the risk of developing a disease by performing a correlation analysis between supplement prescription data and customer health data for multiple types of supplements

**Products in a broad sense**

■ Supplements and associated activities

➢ Examples of associated activities

- ✓ Service to diagnose current health
- ✓ Service for recommending supplements suitable to the current health
- ✓ Follow-up service, such as checking health after supplements have been prescribed

**Products in a narrow sense**

■ Supplements

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# Chapter 3

# Human Resource Types & Roles

a. Business Architects

b. Designers

c. Data Scientists

d. Software Engineers

e. Cyber Security

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# What Are Designers?

**Definition**

**Human resources who take a comprehensive view of the circumstances incorporating perspectives such as the business perspective and the customer/user perspective, create policies for products and services and establish development processes, and design the form that products and services are to take in line with these**

## ◆ Reason for defining designers

- ✓ **This type was defined on the basis of the thinking that human resources who bring to fruition the transformation of the business itself**—the process beyond the utilization of data and digital technology—**by taking not only the business perspective, but also the customer/user perspective as their starting point are required** as human resources who promote DX.
- ✓ According to the Design Policy Handbook 2020 compiled by the Ministry of Economy, Trade and Industry (METI), major changes in markets, technology, and society are driving **a change in the role required of design from simply making forms more aesthetically appealing to serving as a means of creating value and solving problems that takes people as its starting point**. In light of this change in the role expected of design, designers have been defined as human resources who bring to fruition business transformation from the customer/user perspective.

## ◆ Settings in which designers play a part

- ✓ The settings in which designers play a part **focus solely on initiatives that utilize individual datasets or digital technologies (envisaged on the basis of individual products, services and operations)**, and exclude initiatives that relate to the enhancement of organizational capabilities (creation of organizations for instilling design thinking throughout the company, and human resource development).
  - This is because the human resources envisaged in the DSS-P **are not expected to be at a management level at which they hold responsibility for companywide initiatives**
  - However, as the nature of a project may in some cases require organizational capabilities to be enhanced, the type has been defined in such a way that human resources within the designer type should also have skills in this area
- ✓ Within individual initiatives, **there may also be cases in which the product or service is supplied to an internal customer.**
- ✓ Within individual initiatives, it is envisaged that **designers will play a part in all DX promotion processes** (e.g. planning, implementation, hypothesis verification, verification of effects after introduction, etc.). In light of changes in the role expected of design, **designers will play a part** not only in the design of visual appearance, **but also in the planning of new products and services**.

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# What Are Designers? | Expected Roles (1/2)

- The specific roles expected of a designer and actions required of them are as follows:

### ◆ Provision of guidance to ensure relevant parties in the initiative always remain conscious of the customer/user perspective approach

✓ The customer/user perspective approach has a tendency to be overlooked. To ensure this approach does not fall by the wayside, designers are required to provide support in all settings of a DX initiative, so that the relevant parties carry the initiative forward with the customer/user perspective in mind. The envisaged content of a designer's role includes matters such as the following examples:

- At the product/service planning stage, checking that the company's perspective, such as profitability and cost-cutting, is not the sole consideration, and facilitating consideration of the customer/user perspective
- In situations involving the development of applications and the like, checking not only whether the requisite functions have been implemented, but also whether usability (ease of understanding, ease of finding and ease of use) from the customer/user perspective has been achieved

### ◆ Design of points of contact with the customer/user (point of contact between the product/service and the customer/user) on the basis of an ethical perspective

✓ Designers are required to design points of contact with the customer/user with consideration not only for the questions of whether the product/service is easy for the customer/user to understand and/or find, and whether it appeals to them, but also for its ethical appropriateness (e.g. whether it makes unethical inducements).

✓ Designers are required to design products/services on the basis of human behavioral principles and psychology, and also to check the product/service created from an ethical perspective and, if unethical elements are discovered, to send the product/service back for amendment.

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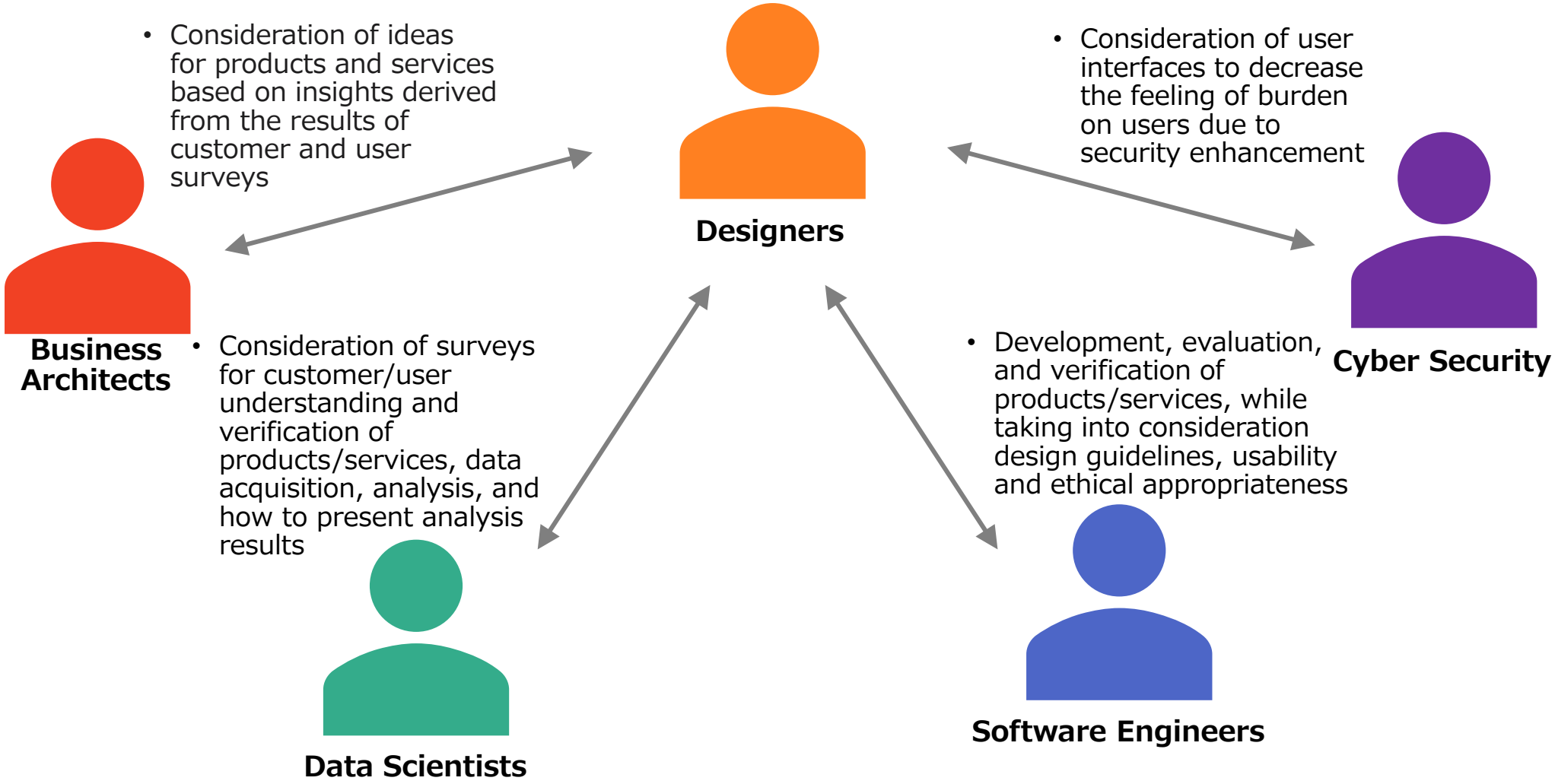
# What Are Designers? | Expected Roles (2/2)

- The following shows an example of an operation in which a designer collaborates with the other human resource types.
- The two-way arrows represent the relationships between each type, to indicate that two or more human resource types build collaborative working relationships in a range of situations, rather than being a situation in which one type issues instructions or requests to another.

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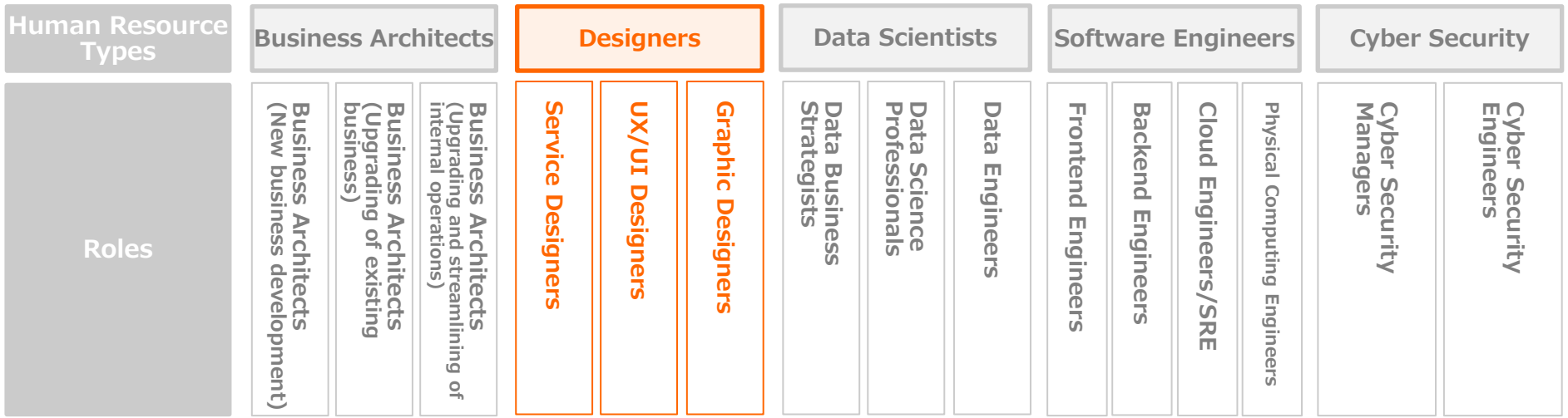
# Roles of Designers | Definition of Roles




◆ **Roles categorized on the basis of DX promotion processes**

- ✓ The designer type is categorized into a number of roles on the basis of differences in the work carried out.
- ✓ **As it is envisaged that designers will play a part in all DX promotion processes** (e.g. planning, implementation, hypothesis verification, verification of effects after introduction, etc.), these processes have been divided into the three broad groupings below for ease of understanding, and the roles have been broken down in accordance with these.
  - ① Definition of value proposition, design of product and service business models and business processes, and creation of policies (concepts)
  - ② Consideration of customer/user experience for products and services, information design, and design of functions, information deployment, appearance, and dynamic elements
  - ③ Creation of concrete realizations of brand image, and design of digital graphics, marketing media and other such things
- ✓ With regard to ②, as design must be carried out with consideration for UX (customer/user experience of the product/service) **and there is a possibility that a product or service might not be able to achieve the value proposition if designed in isolation from UX, UX design and UI design have been defined as a unified role**.
- ✓ The ways in which designers handle the roles set out here in the course of promoting a company's DX will vary. **It is also envisaged that several people might handle a single role, or that one person might handle several roles**, depending on the size of the company or the scale of the themes being addressed.
- ✓ Of these roles, **UX/UI designer is regarded as the role with which companies about to embark on DX promotion should equip themselves as a particular priority**.
  However, when undertaking companywide transformation in larger-scale companies, **service designers** may also prove to be useful.
  - This is because, while the consideration of customer/user experience and design of products and services are the core work of designers in DX promotion initiatives, service designers are able to cover the business architect type to a certain extent, whereas companies conceivably have the option of outsourcing the work of graphic designers, due to the high level of expertise

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# Roles of Designers | Approach to Skill Mapping

## Service designer

- ✓ **In skills associated with customer/user understanding and value discovery/definition, both knowledge and a high level of practical ability are required.**
  - These are needed when identifying challenges for customers/users, defining the value proposition and creating policies (concepts) for products and services
- ✓ **With regard to skills associated with strategy/management/systems and business model/processes, too, designers in this role need to have wide-ranging knowledge and practical ability** at a level that enables them to put their skills into practice while collaborating with business architects.
  - These are needed when identifying challenges for society and both internal and external relevant parties (relevant parties in the provision of products and services), designing mechanisms for continuously realizing policies (concepts) for products and services, and collaborating with business architects to verify feasibility from a business perspective

## UX/UI designer

- ✓ **In skills associated with customer/user understanding, value discovery/definition and design, both knowledge and a high level of practical ability are required.**
  - These are needed when considering customer/user experience, undertaking information design, and designing functions, information deployment, appearance, and dynamic elements
- ✓ **With regard to skills associated with technology and the privacy protection skill** required when designing points of contact with customers/users, too, **designers in this role need to have wide-ranging knowledge** at a level that enables them to put their skills into practice while collaborating with other human resource types (such as software engineers and cyber security).
  - These are needed when producing prototypes of products and services in collaboration with other human resource types (such as software engineers and cyber security)

## Graphic designer

- ✓ **In other design technology skills, both knowledge and a high level of practical ability are required.**
  - These are needed when undertaking digital-related design, including digital graphics and marketing media, and also for general design of all kinds of content in the course of rolling out businesses, products and services
- ✓ **With regard to skills associated with marketing and branding, too, designers in this role need to have knowledge and practical ability** at a level that enables them to put their skills into practice while collaborating with marketing and branding professionals.
  - These are needed when collaborating with marketing and branding professionals on efforts to visualize and create concrete realizations of brand image

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# Roles of Designers | Responsibilities/Main Work & Skills (1/3)

| | |
|---|---|
| **Human Resource Type** | Designer |
| **Role** | **Service designer** |
| **Responsibilities in DX Promotion** | Define the value proposition in the context of the challenges of society, customers, users, and both internal and external involved parties in the provision of products and services, create policies (concepts) for products and services, and design mechanisms for continuously realizing them |
| **Main Work** | • Identify through market research and customer/user surveys the challenges faced by society, customers and users, and all stakeholders involved in the provision of a product/service, and define the value proposition while taking into account the perspectives of customers/users, the business and technology<br>• Based on the value proposition, create policies (concepts) for products and services, and design mechanisms for continuously realizing them<br>• Verify the feasibility of the value proposition and product/service policies (whether the product/service can actually provide the desired experience to the customer/user, whether the product/service is useful to the customer/user, and whether the product/service is feasible as a business) at every stage, from hypothesis verification (PoC, etc.) to full-scale introduction and also after introduction<br>• In the process of creating plans, form a consensus among those collaborating on tasks and among customers/users, design (coordinate) forums for leading them to the same goal and facilitate those forums |

**Required Skills**

| Category | Subcategory | Skills | Importance |
|---|---|---|---|
| Business transformation | Strategy/ management/ systems | Business strategy formulation and execution | b |
| | | Product management | b |
| | | Transformation management | b |
| | | Systems engineering | c |
| | | Enterprise architecture | c |
| | | Project management | c |
| | Business model/ processes | Business surveys | b |
| | | Business model design | b |
| | | Business analysis | b |
| | | Verification (business perspective) | b |
| | | Marketing | b |
| | | Branding | c |
| | Design | Customer/user understanding | a |
| | | Value discovery/definition | a |
| | | Design | b |
| | | Verification (customer/user perspective) | a |
| | | Other design technology | c |

| Category | Subcategory | Skills | Importance |
|---|---|---|---|
| Data utilization | Strategic utilization of data/AI | Data understanding/utilization | c |
| | | Data/AI utilization strategy | c |
| | | Design, implementation and evaluation of operations that utilize data/AI | c |
| | AI/data science | Mathematical statistics/multivariate analysis/data visualization | d |
| | | Machine learning/deep learning | d |
| | Data engineering | Data utilization infrastructure design | d |
| | | Data utilization infrastructure implementation/operation | d |
| Technology | Software development | Computer science | d |
| | | Team development | d |
| | | Software design methods | d |
| | | Software development processes | d |
| | | Web application fundamental technology | d |
| | | Frontend system development | d |
| | | Backend system development | d |
| | | Utilization of cloud infrastructure | d |
| | | SRE processes | d |
| | | Service utilization | d |

| Category | Subcategory | Skills | Importance |
|---|---|---|---|
| Technology | Digital technology | Physical computing | c |
| | | Other cutting-edge technology | d |
| | | Technology trends | c |
| Security | Security management | Security organization establishment and operation | d |
| | | Security management | c |
| | | Incident response and business continuity | c |
| | | Privacy protection | c |
| | Security technology | Secure design, development and implementation | d |
| | | Security operation, maintenance and monitoring | d |
| Personal skills | Human skills | Leadership | z |
| | | Collaboration | z |
| | Conceptual skills | Goal setting | z |
| | | Creative problem solving | z |
| | | Critical thinking | z |
| | | Adaptability | z |

[Importance key]
a High level of practical ability and expertise required
b A certain level of practical ability and expertise required
c Ability to provide an explanation required
d Understanding of positioning and relevance required
z Practical ability corresponding to role and situation is required

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# Roles of Designers | Responsibilities/Main Work & Skills (2/3)

| | |
|---|---|
| **Human Resource Type** | Designer |
| **Role** | **UX/UI designer** |
| **Responsibilities in DX Promotion** | Design customer/user experience for products and services based on value propositions, undertake the information design of products and services, and design functions, information deployment, appearance, and dynamic elements |
| **Main Work** | • Based on the value proposition, visualize the behavior of customers/users at their point of contact with the product/service and the situations, thinking and emotions that lead up to that behavior, and design the customer/user experience for the product/service<br>• Realize the product/service policy (concept) in the form of concrete specifications, guidelines, design principles and the like, and undertake the information design for the product/service, along with the design of functions, information deployment, appearance, and dynamic elements (look & feel)<br>• Produce prototypes of web content, applications and the like that are aligned with the branding and marketing measures, at every stage, from PoC to full-scale introduction and also after introduction<br>• Conduct usability evaluation (verification of whether the customer/user was able to reach the information they sought without getting confused) at every stage, from PoC to full-scale introduction and also after introduction |

**Required Skills**

| Category | Subcategory | Skills | Importance |
|---|---|---|---|
| Business transformation | Strategy/ management/ systems | Business strategy formulation and execution | d |
| | | Product management | c |
| | | Transformation management | d |
| | | Systems engineering | d |
| | | Enterprise architecture | d |
| | | Project management | c |
| | Business model/ processes | Business surveys | d |
| | | Business model design | d |
| | | Business analysis | d |
| | | Verification (business perspective) | d |
| | | Marketing | b |
| | | Branding | c |
| | Design | Customer/user understanding | a |
| | | Value discovery/definition | a |
| | | Design | a |
| | | Verification (customer/user perspective) | a |
| | | Other design technology | c |

| Category | Subcategory | Skills | Importance |
|---|---|---|---|
| Data utilization | Strategic utilization of data/AI | Data understanding/utilization | d |
| | | Data/AI utilization strategy | d |
| | | Design, implementation and evaluation of operations that utilize data/AI | d |
| | AI/data science | Mathematical statistics/multivariate analysis/data visualization | d |
| | | Machine learning/deep learning | d |
| | Data engineering | Data utilization infrastructure design | d |
| | | Data utilization infrastructure implementation/operation | d |
| Technology | Software development | Computer science | c |
| | | Team development | b |
| | | Software design methods | c |
| | | Software development processes | c |
| | | Web application fundamental technology | c |
| | | Frontend system development | c |
| | | Backend system development | c |
| | | Utilization of cloud infrastructure | c |
| | | SRE processes | c |
| | | Service utilization | c |

| Category | Subcategory | Skills | Importance |
|---|---|---|---|
| Technology | Digital technology | Physical computing | c |
| | | Other cutting-edge technology | d |
| | | Technology trends | c |
| Security | Security management | Security organization establishment and operation | d |
| | | Security management | d |
| | | Incident response and business continuity | d |
| | | Privacy protection | c |
| | Security technology | Secure design, development and implementation | d |
| | | Security operation, maintenance and monitoring | d |
| Personal skills | Human skills | Leadership | z |
| | | Collaboration | z |
| | Conceptual skills | Goal setting | z |
| | | Creative problem solving | z |
| | | Critical thinking | z |
| | | Adaptability | z |

[Importance key]
a High level of practical ability and expertise required
b A certain level of practical ability and expertise required
c Ability to provide an explanation required
d Understanding of positioning and relevance required
z Practical ability corresponding to role and situation is required

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# Roles of Designers | Responsibilities/Main Work & Skills (3/3)

| | |
|---|---|
| **Human Resource Type** | Designer |
| **Role** | **Graphic designer** |
| **Responsibilities in DX Promotion** | Create concrete realizations of brand image, and design digital graphics, marketing media, and other such things with a sense of unification as a brand |
| **Main Work** | ・Create concrete realizations of brand image, and design of digital graphics, marketing media and other such things |

**Required Skills**

| Category | Subcategory | Skills | Importance |
|---|---|---|---|
| Business transformation | Strategy/ management/ systems | Business strategy formulation and execution | d |
| | | Product management | d |
| | | Transformation management | d |
| | | Systems engineering | d |
| | | Enterprise architecture | d |
| | | Project management | c |
| | Business model/ processes | Business surveys | d |
| | | Business model design | d |
| | | Business analysis | d |
| | | Verification (business perspective) | d |
| | | Marketing | b |
| | | Branding | b |
| | Design | Customer/user understanding | c |
| | | Value discovery/definition | c |
| | | Design | c |
| | | Verification (customer/user perspective) | c |
| | | Other design technology | a |

| Category | Subcategory | Skills | Importance |
|---|---|---|---|
| Data utilization | Strategic utilization of data/AI | Data understanding/utilization | d |
| | | Data/AI utilization strategy | d |
| | | Design, implementation and evaluation of operations that utilize data/AI | d |
| | AI/data science | Mathematical statistics/multivariate analysis/data visualization | d |
| | | Machine learning/deep learning | d |
| | Data engineering | Data utilization infrastructure design | d |
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| | | Backend system development | d |
| | | Utilization of cloud infrastructure | d |
| | | SRE processes | d |
| | | Service utilization | d |

| Category | Subcategory | Skills | Importance |
|---|---|---|---|
| Technology | Digital technology | Physical computing | d |
| | | Other cutting-edge technology | d |
| | | Technology trends | d |
| Security | Security management | Security organization establishment and operation | d |
| | | Security management | d |
| | | Incident response and business continuity | d |
| | | Privacy protection | d |
| | Security technology | Secure design, development and implementation | d |
| | | Security operation, maintenance and monitoring | d |
| Personal skills | Human skills | Leadership | z |
| | | Collaboration | z |
| | Conceptual skills | Goal setting | z |
| | | Creative problem solving | z |
| | | Critical thinking | z |
| | | Adaptability | z |

[Importance key]
a High level of practical ability and expertise required
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c Ability to provide an explanation required
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z Practical ability corresponding to role and situation is required

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# Supplementary Material | Changes in the Role Expected of Design

- According to the Design Policy Handbook 2020 compiled by METI, major changes in markets, technology, and society are driving a change in the role required of design from simply making forms more aesthetically appealing to serving as a means of creating value and solving problems that takes people as its starting point.

Today, due to economic globalization and the emerging economies that have come to the fore, markets are full of outstanding products and services, while people's values are becoming increasingly diverse and their needs more advanced. Amid this situation, the creation of the value truly sought by customers and of value that goes beyond customer expectations is a challenge. In addition, the wave of the Fourth Industrial Revolution symbolized by AI, the IoT and other innovations in the technological field is, along with advances in the digital economy, having a major impact on existing industries. As such, the creation of businesses unconstrained by conventional thinking is required. Furthermore, at a time when the international community is promoting initiatives aimed at creating sustainable societies, the very nature of corporations is starting to be fundamentally challenged.

Thus, against the background of major changes in markets, technology and society, along with increasingly complex issues surrounding companies, the role that design is expected to play is also changing. Specifically, the role required of design is not merely to make individual products and the like more beautiful in form or easier to use, but also to make the entire experience of people using products and services more pleasant and appealing, and even to create more desirable, vibrant ecosystems, including those associated with business models, organizations and communities. It would be fair to say that today, design should be regarded as a means of creating value and solving problems that takes people as its starting point.

Source: Ministry of Economy, Trade and Industry Cool Japan Policy Division & Design Policy Office, Design Policy Handbook 2020 (April 2020)

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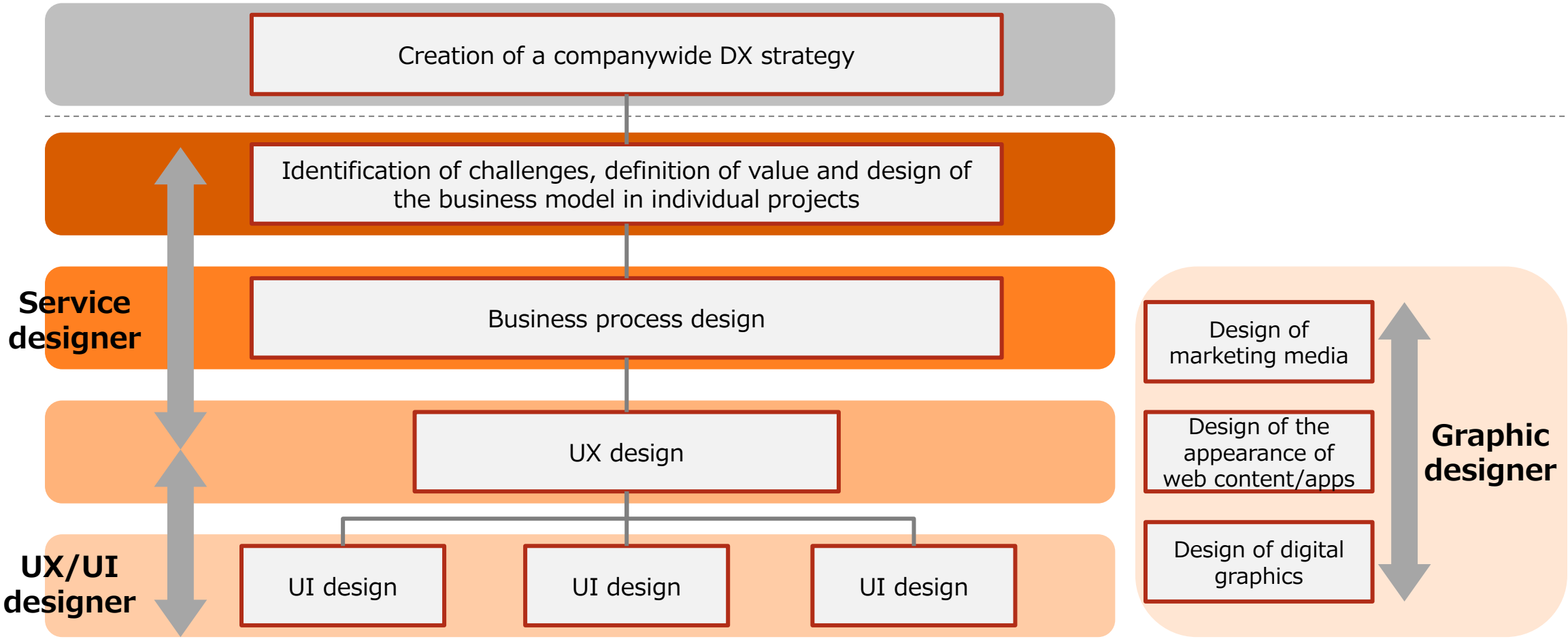
# Supplementary Material | Focus of Design Work in Each Role

- The focus of design work in each role in the DSS-P is as follows:

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# Chapter 3

# Human Resource Types & Roles

a. Business Architects
b. Designers
c. Data Scientists
d. Software Engineers
e. Cyber Security

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# What Are Data Scientists?

**Definition**

**Human resources who, in the promotion of DX, design, implement, and operate mechanisms for the gathering and analysis of data toward transformation of operations and realization of new businesses through use of data**

## ◆ What are data scientists in the promotion of DX?

- ✓ With the advancement of computerization and digitalization throughout society, the amount of data generated in an organization or company is dramatically growing, and the maintenance and effective use of data in a company or organization have recently become an extremely important challenge in increasing the competitiveness of the company or organization. It is no exaggeration to say that, **today, the success of DX depends on the ability to make effective use of data**.
- ✓ Data scientists are **human resources who promote DX mainly in the field of data utilization, which is thus essential in the DX of a company or organization**. They play the core role in the promotion of DX centered on data utilization.

## ◆ Data utilization operations performed by a data scientist

- ✓ A data scientist not only analyzes data but **performs a wide range of operations** from consideration of business strategies through use of data to consideration of data gathering methods and mechanisms, as well as the design, creation, and operation of an environment for conducting data analysis. Moreover, a data scientist also takes charge of such operations as actually transforming work-site operations by introducing a data utilization mechanism in the work-site operations and providing work-site users with explanations or education on how to use that mechanism.
- ✓ As such, in the field of data utilization, a data scientist takes charge of all processes from the formulation of strategies to hypothesis verification, implementation, operation, and effect verification/improvement. Therefore, the operations performed by a data scientist sometimes also require the skills required of other human resource types, such as the business skills required of a business architect and a designer as well as the technical skills required of a software engineer and cyber security.
- ✓ Data scientists are characterized by the fact that, because they perform a wide range of operations centered on their expertise in the field of data utilization, **they are required to have diverse skills in order to play active roles as human resources with the skill level assumed by these Skill Standards**.

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# What Are Data Scientists? | Expected Roles (1/2)

- The specific roles expected of a data scientist and actions required of them are as follows:

### ◆ Achievement of data utilization that increases the competitiveness of their company or organization

- ✓ The roles expected of a data scientist are to promote DX initiatives through the discovery and utilization of data, and to contribute to the ultimate goal of increasing the competitiveness of their company or organization. While the utilization and analysis of data are themselves tasks that require a high level of expertise, a data scientist needs to have a strong awareness not only of data utilization and analysis work in its own right, but also of the fact that efforts to ensure the outcomes **increase the competitiveness of their company or organization are essential**.

- ✓ The DSS-P includes not only data scientists who are directly involved in products and services aimed at customers outside the company, but also data scientists who provide services to users within the company. However, even in cases that involve carrying out work for internal customers, it is vital that data scientists remain aware at all times of the need to confirm **whether the outcomes of their work ultimately provide value to the customer within their company or organization, and whether these outcomes contribute adequately to the increase of customer value**.

### ◆ Handling of matters related to the field of data utilization in DX and flexible collaboration with other human resource types as needed

- ✓ While data scientists are defined as the human resource type that takes responsibility for executing work in the data utilization field in the context of a DX initiative, there are cases in which data scientists alone may promote DX if data utilization is the principal goal of the DX initiative in question.

- ✓ However, if the DX initiative in question is broader in scope and includes fields other than data utilization, this human resource type will be required to **fulfill their role effectively within the DX initiative as a whole, while collaborating flexibly with other human resource types,** including business architects, designers, software engineers and cyber security.

- ✓ There is a strong expectation that data scientists will not only have an adequate understanding of customers/users associated with data utilization, and of the requirements and needs of other human resource types with which they collaborate in DX initiatives, but also, on occasion, **identify new business creation opportunities and possibilities for business process re-engineering on the basis of potential needs** of which these relevant parties are **not yet fully aware**.

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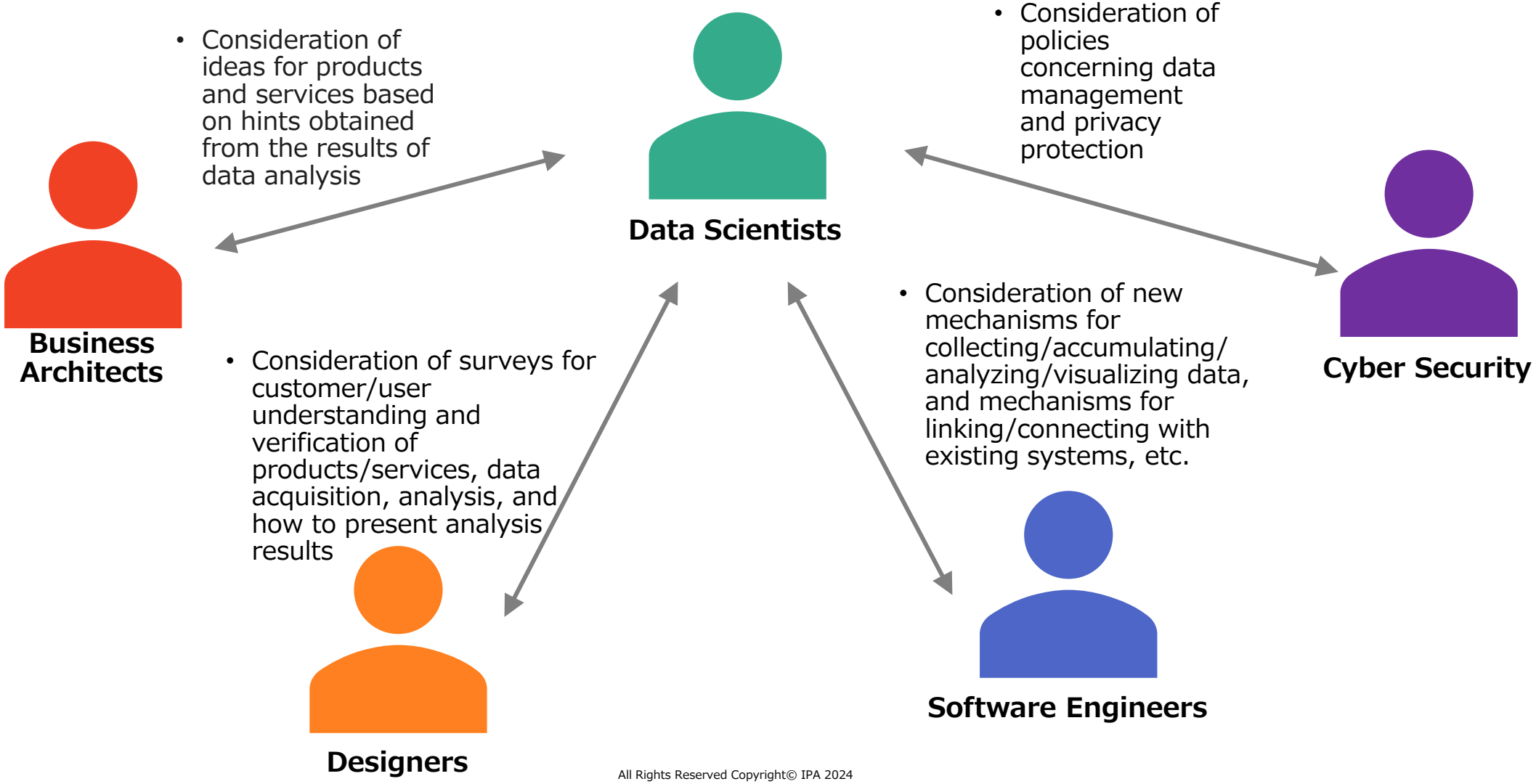
# What Are Data Scientists? | Expected Roles (2/2)

- The following shows an example of an operation in which a data scientist collaborates with the other human resource types.
- The two-way arrows represent the relationships between each type, to indicate that two or more human resource types build collaborative working relationships in a range of situations, rather than being a situation in which one type issues instructions or requests to another.

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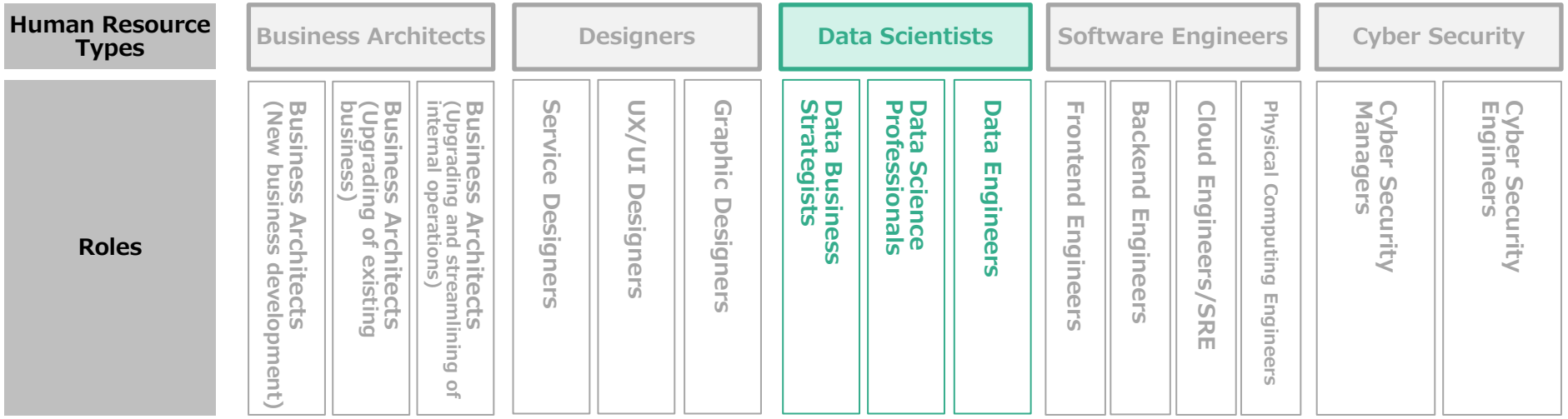
# Roles of Data Scientists




## ◆ Approach to the categorization of roles

- ✓ The data scientist type is categorized into a number of roles on the basis of differences in the work carried out.
- ✓ The data business strategist role is defined as one that involves the formulation of data utilization strategies based on business strategies, the management of other roles and the promotion of collaboration with other human resource types. The data science professional role is defined as one that involves the handling of tasks including data processing and analysis, along with the evaluation of the results thereof, on the basis of expertise in the data science field. The data engineer role is defined as one that involves the design, implementation and operation of an effective data analysis environment.
- ✓ The roles within the data scientist type have been categorized with reference to the **three competences required of data scientists** (business problem solving competence, data science competence and data engineering competence) defined by the **Japan DataScientist Society**. In these Skill Standards, the three competences have been divided into three roles and defined accordingly.

## ◆ Career advancement as a data scientist

- ✓ Human resources who aim to become data scientists are expected to increase their expertise, starting with a field in which they show strength in regard to one of the aforementioned three roles. However, where human resources wish to broaden the scope of their activity as data scientists and achieve career advancement, it is desirable for them to gradually gain the ability to handle multiple roles, with their field of strength at the core.

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# Roles of Data Scientists | Approach to Skill Mapping

## Data business strategist

- ✓ A data business strategist's role is to formulate data strategies based on business strategies, manage projects in the field of data utilization, and work with front-line departments to design and review operations that utilize data. In other words, one could say that **a data business strategist's role is to serve as a bridge connecting data scientists with other human resource types who promote DX and front-line departments within their own company, among others**.
- ✓ To fulfill this role, there is a stronger need for data business strategists to have business and managerial skills than there is for other roles within this human resource type. Those who hold this role also require knowledge and a high level of practical ability in relation to various legal systems, including privacy protection.

## Data science professional

- ✓ A data science professional's role is to carry out data processing and analysis, evaluate the results and produce knowledge that will lead to the creation of new business and the transformation and improvement of operations on the ground. As another role of data science professionals is the creation of mechanisms for data utilization in front-line departments, along with education and support for end users, **they are not only responsible for data processing and analysis, but also take a certain level of responsibility in situations involving the utilization of the results.**
- ✓ Given that they handle the roles described above, data science professionals need to have both skills related to data analysis and the evaluation of the results, and an average level of personal and other skills required to communicate appropriately with a diverse array of relevant parties, including front-line users.
- ✓ In addition, as their role also involves grasping trends in cutting-edge technology—primarily in the rapidly advancing field of data science—and verifying whether those technologies can be utilized in their own company, data science professionals need to have a deeper understanding of other cutting-edge technology than other roles within this human resource type.

## Data engineer

- ✓ A data engineer's role is to **design, implement and operate a data analysis environment** optimized for real-time, dynamic and automatic data analysis, to serve as data utilization infrastructure.
- ✓ To fulfill this role, data engineers need to have as high a level of practical ability as software engineers in relation to both backend system development and the utilization of cloud infrastructure.

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# Roles of Data Scientists | Responsibilities/Main Work & Skills (1/3)

**Human Resource Type**

Data scientist

**Role**

## Data business strategist

**Responsibilities in DX Promotion**

Consider data utilization strategy in line with enterprise strategy, and lead the way in realizing and executing the strategy while achieving business transformation to increase customer value and creating new business

**Main Work**

- Make judgments concerning the pros and cons of data utilization in their company's business strategy and formulate a data utilization strategy for achieving the business strategy
- Plan and lead processes until the data utilization strategy is achieved, coordinate collaboration with other human resource types and roles, and manage projects in the data utilization field
- Work with front-line departments to design and review operations that utilize data, and also create new business and achieve front-line business transformation and improvement
- Identify the outcomes and challenges of initiatives, and feed these insights into the next initiative

**Required Skills**

| Category | Subcategory | Skills | Importance |
|---|---|---|---|
| Business transformation | Strategy/ management/ systems | Business strategy formulation and execution | b |
| | | Product management | c |
| | | Transformation management | c |
| | | Systems engineering | c |
| | | Enterprise architecture | c |
| | | Project management | b |
| | Business model/ processes | Business surveys | b |
| | | Business model design | b |
| | | Business analysis | b |
| | | Verification (business perspective) | b |
| | | Marketing | c |
| | | Branding | c |
| | Design | Customer/user understanding | b |
| | | Value discovery/definition | b |
| | | Design | c |
| | | Verification (customer/user perspective) | b |
| | | Other design technology | d |

| Category | Subcategory | Skills | Importance |
|---|---|---|---|
| Data utilization | Strategic utilization of data/AI | Data understanding/utilization | a |
| | | Data/AI utilization strategy | a |
| | | Design, implementation and evaluation of operations that utilize data/AI | a |
| | AI/data science | Mathematical statistics/multivariate analysis/data visualization | c |
| | | Machine learning/deep learning | c |
| | Data engineering | Data utilization infrastructure design | c |
| | | Data utilization infrastructure implementation/operation | c |
| Technology | Software development | Computer science | d |
| | | Team development | b |
| | | Software design methods | c |
| | | Software development processes | c |
| | | Web application fundamental technology | d |
| | | Frontend system development | d |
| | | Backend system development | d |
| | | Utilization of cloud infrastructure | d |
| | | SRE processes | c |
| | | Service utilization | c |

| Category | Subcategory | Skills | Importance |
|---|---|---|---|
| Technology | Digital technology | Physical computing | c |
| | | Other cutting-edge technology | c |
| | | Technology trends | c |
| Security | Security management | Security organization establishment and operation | d |
| | | Security management | c |
| | | Incident response and business continuity | c |
| | | Privacy protection | b |
| | Security technology | Secure design, development and implementation | d |
| | | Security operation, maintenance and monitoring | d |
| Personal skills | Human skills | Leadership | z |
| | | Collaboration | z |
| | Conceptual skills | Goal setting | z |
| | | Creative problem solving | z |
| | | Critical thinking | z |
| | | Adaptability | z |

[Importance key]
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b A certain level of practical ability and expertise required
c Ability to provide an explanation required
d Understanding of positioning and relevance required
z Practical ability corresponding to role and situation is required

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# Roles of Data Scientists | Responsibilities/Main Work & Skills (2/3)

| | |
|---|---|
| **Human Resource Type** | Data Scientist |
| **Role** | **Data science professional** |
| **Responsibilities in DX Promotion** | Use data processing and analysis to elicit meaningful knowledge that will lead to operational transformation and business creation to increase customer value |
| **Main Work** | ・Data processing and analysis based on specialist knowledge in the fields of AI and data science, and suitably evaluating and analyzing the results<br>・Using data processing and analysis results to produce knowledge that will lead to the creation of new business and the transformation and improvement of operations on the ground, and suitably visualizing this<br>・Creation of mechanism for data utilization in front-line departments, education and support for end users<br>・Improvement of analysis models in reflection on the operating state of mechanisms for data utilization and new business demands<br>・Gaining an understanding of new technology in the fields of AI and data science, and verifying its potential |

**Required Skills**

| Category | Subcategory | Skills | Importance |
|---|---|---|---|
| Business transformation | Strategy/ management/ systems | Business strategy formulation and execution | d |
| | | Product management | c |
| | | Transformation management | c |
| | | Systems engineering | c |
| | | Enterprise architecture | d |
| | | Project management | c |
| | Business model/ processes | Business surveys | d |
| | | Business model design | c |
| | | Business analysis | c |
| | | Verification (business perspective) | c |
| | | Marketing | d |
| | | Branding | d |
| | Design | Customer/user understanding | c |
| | | Value discovery/definition | c |
| | | Design | d |
| | | Verification (customer/user perspective) | b |
| | | Other design technology | d |

| Category | Subcategory | Skills | Importance |
|---|---|---|---|
| Data utilization | Strategic utilization of data/AI | Data understanding/utilization | b |
| | | Data/AI utilization strategy | c |
| | | Design, implementation and evaluation of operations that utilize data/AI | b |
| | AI/data science | Mathematical statistics/multivariate analysis/data visualization | a |
| | | Machine learning/deep learning | a |
| | Data engineering | Data utilization infrastructure design | c |
| | | Data utilization infrastructure implementation/operation | c |
| Technology | Software development | Computer science | b |
| | | Team development | b |
| | | Software design methods | c |
| | | Software development processes | c |
| | | Web application fundamental technology | d |
| | | Frontend system development | d |
| | | Backend system development | d |
| | | Utilization of cloud infrastructure | d |
| | | SRE processes | c |
| | | Service utilization | c |

| Category | Subcategory | Skills | Importance |
|---|---|---|---|
| Technology | Digital technology | Physical computing | c |
| | | Other cutting-edge technology | c |
| | | Technology trends | c |
| Security | Security management | Security organization establishment and operation | d |
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| | | Incident response and business continuity | c |
| | | Privacy protection | b |
| | Security technology | Secure design, development and implementation | d |
| | | Security operation, maintenance and monitoring | d |
| Personal skills | Human skills | Leadership | z |
| | | Collaboration | z |
| | Conceptual skills | Goal setting | z |
| | | Creative problem solving | z |
| | | Critical thinking | z |
| | | Adaptability | z |

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d Understanding of positioning and relevance required
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# Roles of Data Scientists | Responsibilities/Main Work & Skills (3/3)

| | |
|---|---|
| **Human Resource Type** | Data Scientist |
| **Role** | **Data engineer** |
| **Responsibilities in DX Promotion** | Realize operational transformation and business creation to increase customer value through the design, implementation, and operation of an effective data analysis environment |
| **Main Work** | ・Design a system environment that allows the collection, processing and analysis of data appropriate to the goal (e.g. operational data or log data), among others, to be carried out effectively, lead its implementation and achieve its optimal operation<br>・Coordinate and achieve an optimal real-time, dynamic and automatic data analysis environment in accordance with changes in the situation<br>・Process data and create data marts required for data analysis<br>・Develop an environment that allows other roles to conduct monitoring appropriately |

**Required Skills**

| Category | Subcategory | Skills | Importance |
|---|---|---|---|
| Business transformation | Strategy/ management/ systems | Business strategy formulation and execution | d |
| | | Product management | c |
| | | Transformation management | c |
| | | Systems engineering | b |
| | | Enterprise architecture | b |
| | | Project management | c |
| | Business model/ processes | Business surveys | d |
| | | Business model design | d |
| | | Business analysis | c |
| | | Verification (business perspective) | d |
| | | Marketing | d |
| | | Branding | d |
| | Design | Customer/user understanding | c |
| | | Value discovery/definition | c |
| | | Design | c |
| | | Verification (customer/user perspective) | c |
| | | Other design technology | d |

| Category | Subcategory | Skills | Importance |
|---|---|---|---|
| Data utilization | Strategic utilization of data/AI | Data understanding/utilization | b |
| | | Data/AI utilization strategy | c |
| | | Design, implementation and evaluation of operations that utilize data/AI | c |
| | AI/data science | Mathematical statistics/multivariate analysis/data visualization | c |
| | | Machine learning/deep learning | c |
| | Data engineering | Data utilization infrastructure design | a |
| | | Data utilization infrastructure implementation/operation | a |
| Technology | Software development | Computer science | b |
| | | Team development | b |
| | | Software design methods | b |
| | | Software development processes | b |
| | | Web application fundamental technology | c |
| | | Frontend system development | c |
| | | Backend system development | b |
| | | Utilization of cloud infrastructure | b |
| | | SRE processes | c |
| | | Service utilization | b |

| Category | Subcategory | Skills | Importance |
|---|---|---|---|
| Technology | Digital technology | Physical computing | c |
| | | Other cutting-edge technology | b |
| | | Technology trends | c |
| Security | Security management | Security organization establishment and operation | d |
| | | Security management | c |
| | | Incident response and business continuity | b |
| | | Privacy protection | b |
| | Security technology | Secure design, development and implementation | b |
| | | Security operation, maintenance and monitoring | c |
| Personal skills | Human skills | Leadership | z |
| | | Collaboration | z |
| | Conceptual skills | Goal setting | z |
| | | Creative problem solving | z |
| | | Critical thinking | z |
| | | Adaptability | z |

[Importance key]
a High level of practical ability and expertise required
b A certain level of practical ability and expertise required
c Ability to provide an explanation required
d Understanding of positioning and relevance required
z Practical ability corresponding to role and situation is required

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# Chapter 3

# Human Resource Types & Roles

a. Business Architects

b. Designers

c. Data Scientists

**d. Software Engineers**

e. Cyber Security

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# What Are Software Engineers?

**Definition**

**Human resources who, in the promotion of DX, design, implement, and operate systems and software to provide products and services using digital technology**

◆ **What are software engineers in the promotion of DX?**

- ✓ Software engineers play the biggest role in the implementation of products and services that utilize digital technology and in their introduction and operation phases. Software engineers also play an important role in new product/service creation and business transformation by **facilitating the shift from the planning stage to realization in concrete form**.
- ✓ A software engineer's strength and role is to realize the mechanisms for new products/services and business transformation in concrete form and to **leverage specific technologies to produce outcomes and value from DX**.

◆ **Thinking behind the name "software engineer"**

- ✓ The name "software engineer" has been adopted in these Skill Standards in preference to "engineer" or "IT engineer." This is based on the awareness that, while the ability to handle a diverse array of hardware and devices will be important in the course of the digitalization of various fields in the physical world, **the role of software will increasingly be of even greater importance in the production of outcomes that allow for differentiation**.
- ✓ In addition, the term "software engineer" is one of the longest-established names indicating an engineer in the IT field, and **has continued to be used over the course of modern history, during which time IT has wrought major changes in society**. Furthermore, the name "software engineer" also includes the nuance of an engineer capable of dealing with a wide range of fields and processes, from the definition of software requirements to design, implementation, maintenance and operation.
- ✓ Thus, the name "software engineer" has been adopted in these Skill Standards to include the meaning of **an engineer who, by means of a high level of technical skill capable of wide-ranging application, continues to create the cutting edge in the age to come, just as they have in years gone by**.

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# What Are Software Engineers? | Expected Roles (1/2)

- The specific roles expected of a software engineer and actions required of them are as follows:

### ◆ Contribute to increasing the competitiveness of their company or organization via their high level of technical skill

- ✓ Software engineers are required to use their high level of technical skill in the IT and digital fields to promote DX initiatives and **contribute to increasing the competitiveness of their company or organization**, which is the goal of DX.
- ✓ The DSS-P includes not only software engineers who are directly involved in the development, etc. of products and services aimed at customers outside the company, but also software engineers who provide systems and services, etc. to users within the company, both of whom play important roles in the promotion of DX initiatives. However, in both cases, software engineers must maintain a strong awareness at all times of the need to confirm **whether their work ultimately provides value to customers/users of their company or organization, and whether their work contributes to the increase of their company's customer value**.

### ◆ Collaborate flexibly with other stakeholders and produce value, even amid rapidly changing situations

- ✓ Software engineers are expected to **gain a full understanding of the requests and needs of other stakeholders**, including customers/users and other human resource types with whom they collaborate on DX initiatives, and then to create systems and software of a standard that meets or exceeds those expectations. In particular, as identifying and creating new value is also crucial in DX initiatives, software engineers need to demonstrate a willingness to **discover and understand customer/user needs for themselves**.
- ✓ Depending on the situation, software engineers are also expected to offer their own proposals to customers/users and other human resource types with whom they collaborate on DX initiatives, and to contribute proactively and directly to the creation of new value.
- ✓ In DX initiatives, the requests and need of customers/users and other human resources promoting DX initiatives can change substantially in response to rapidly changing environments and situations. Software engineers must have the technical skill, flexibility and readiness required to be able to respond in a flexible and agile manner, even in the event of changes in the needs of other stakeholders in the process of creating systems and software.

### ◆ Maintain and acquire the high level of technical skill required to be able to create competitive software with their own hands

- ✓ The greatest strength of a software engineer is their ability to swiftly create competitive software with their own hands, without the help of other human resource types or other specialist companies. A software engineer must continuously improve their skills with a view to the maintenance and acquisition of this strength, in order to be able to continue to play an active role as a software engineer.

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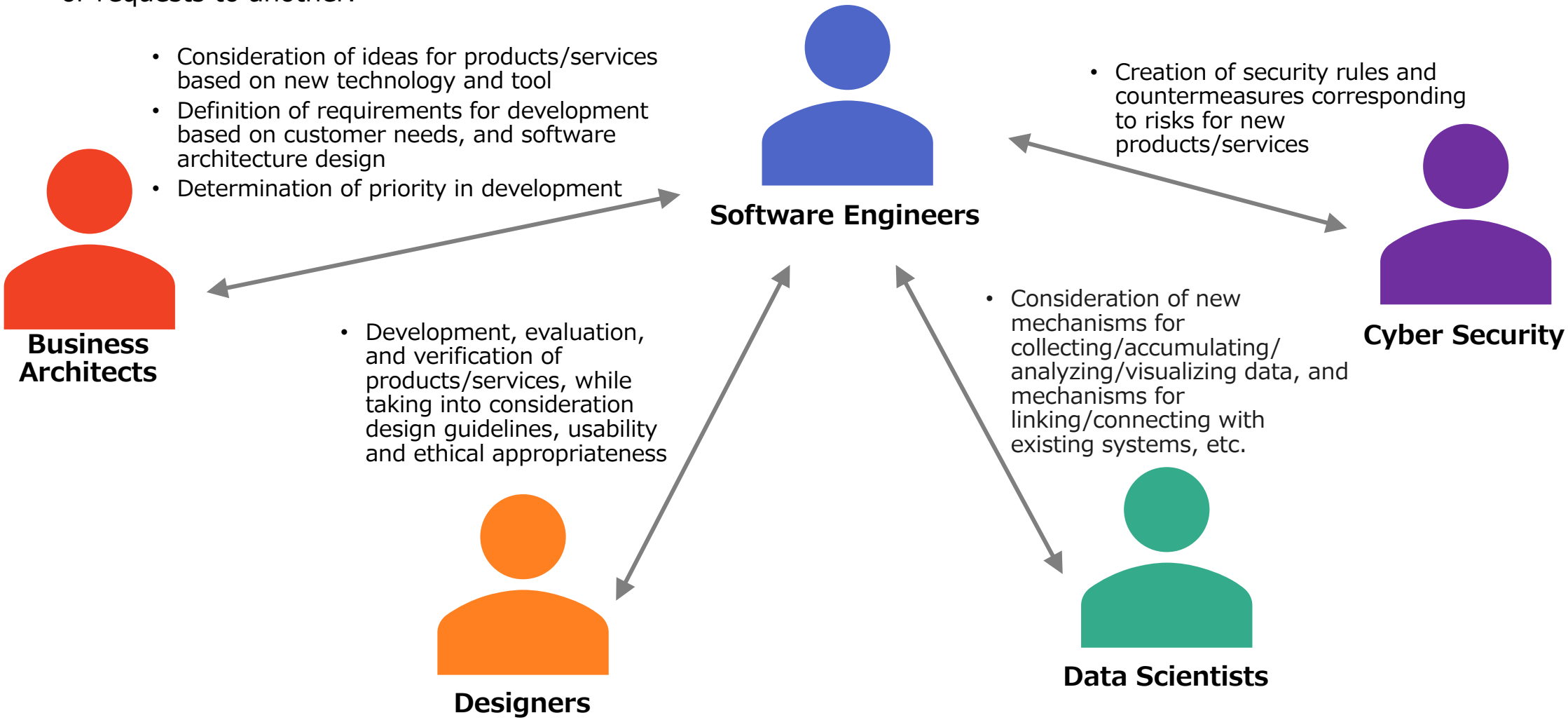
# What Are Software Engineers? | Expected Roles (2/2)

- The following shows an example of an operation in which a software engineer collaborates with the other human resource types.
- The two-way arrows represent the relationships between each type, to indicate that two or more human resource types build collaborative working relationships in a range of situations, rather than being a situation in which one type issues instructions or requests to another.

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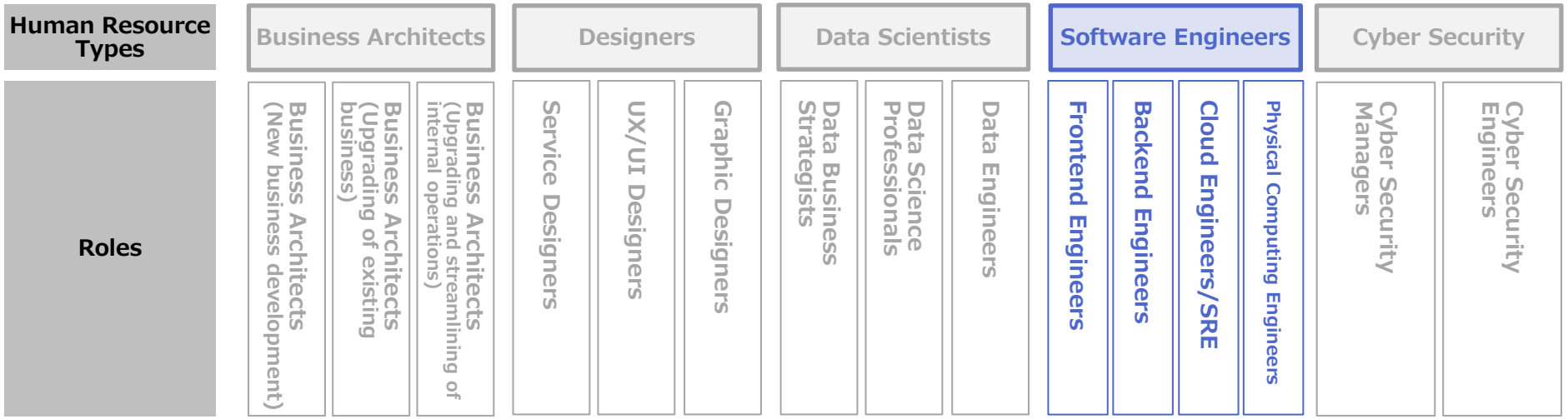
# Roles of Software Engineers




- **Roles categorized on the basis of field of strength**
  - ✓ The software engineer type is categorized into a number of roles on the basis of differences in the work carried out.
  - ✓ Four roles have been defined, corresponding to the fields in which software engineers show strength. Of these roles, those of frontend engineer, backend engineer and cloud engineer / SRE (service reliability engineering) have been defined with an awareness of the **terms used in general job market and the like** nowadays.
  - ✓ The somewhat newer field of physical computing has been defined as a future-focused new role. Due to an awareness of the issue that **the digitalization of fields that were hitherto not digitalized will lead to DX promotion and differentiation**, it was decided to explicitly define roles with skills that involve front-line digitalization and the feedback of information in the virtual realm to the real world. The difference between the real world (physical realm) and the virtual realm is a realm of which service users are not aware; as the skills required have aspects that differ from those in other roles, this has been defined as an independent role, in light also of its future importance.
- **The division of roles**
  - ✓ Consideration of the roles of a software engineer was based on the assumption of a company of sufficient size to have a team of at least 50 or so software engineers, which has brought the development and operation of software in-house. In companies smaller than this, a handful of software engineers or even just one might handle all the roles defined here, while in larger companies, each role might be covered by a whole team. **The division and combination of roles can vary flexibly**, depending on each company's situation.

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# Roles of Software Engineers | Approach to Skill Mapping

## Frontend engineer

- ✓ As frontend engineers handle the aspects of software and applications that involve the development of functions at the front end (interface), as seen from the user's perspective, they need **skills associated with software development that are principally focused on such areas as frontend system development**.
- ✓ In addition to skills associated with **design** and **product management**, they also require skills associated with **project management** and **security technology**.

## Backend engineer

- ✓ As backend engineers handle the development of the server-side functions of software and applications, they need **skills associated with software development that are principally focused on such areas as backend system development and utilization of cloud infrastructure**.
- ✓ In addition to skills associated with **data engineering**, they also require skills associated with **project management** and **security technology**.

## Cloud engineer / SRE (service reliability engineering)

- ✓ As cloud engineers / SRE handle the optimization of cloud-based software development and operating environments, they need in particular **skills associated with software development that are principally focused on such areas as utilization of cloud infrastructure and SRE processes**.
- ✓ In addition to skills associated with **data engineering**, they also require skills associated with **project management** and **security technology (particularly security operation, maintenance and monitoring)**.

## Physical computing engineer

- ✓ As physical computing engineers handle the digitalization of physical spaces, they need **skills associated with communications, networks, and related advanced technologies and the like within the physical computing skill**.
- ✓ In addition to skills associated with **systems engineering**, they also require skills associated with **security technology**.

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# Roles of Software Engineers | Responsibilities/Main Work & Skills (1/4)

| | |
|---|---|
| **Human Resource Type** | Software Engineer |
| **Role** | **Frontend engineer** |
| **Responsibilities in DX Promotion** | Take the main responsibility for mainly implementing interface (client-side) functions among software functions for providing services that leverage digital technology |
| **Main Work** | ・Understand the needs of users of services that utilize digital technology, and design and implement software for the improvement of customer experience value<br>・Implement functions principally related to the interface (client-side) aspects of software in light of feedback from users, while also carrying out prototyping as needed<br>・Undertake improvements and enhancements in light of feedback from users during service operation |

**Required Skills**

| Category | Subcategory | Skills | Importance |
|---|---|---|---|
| Business transformation | Strategy/ management/ systems | Business strategy formulation and execution | d |
| | | Product management | b |
| | | Transformation management | d |
| | | Systems engineering | c |
| | | Enterprise architecture | d |
| | | Project management | b |
| | Business model/ processes | Business surveys | d |
| | | Business model design | d |
| | | Business analysis | c |
| | | Verification (business perspective) | d |
| | | Marketing | d |
| | | Branding | d |
| | Design | Customer/user understanding | c |
| | | Value discovery/definition | c |
| | | Design | b |
| | | Verification (customer/user perspective) | b |
| | | Other design technology | c |

| Category | Subcategory | Skills | Importance |
|---|---|---|---|
| Data utilization | Strategic utilization of data/AI | Data understanding/utilization | b |
| | | Data/AI utilization strategy | c |
| | | Design, implementation and evaluation of operations that utilize data/AI | c |
| | AI/data science | Mathematical statistics/multivariate analysis/data visualization | c |
| | | Machine learning/deep learning | c |
| | Data engineering | Data utilization infrastructure design | c |
| | | Data utilization infrastructure implementation/operation | c |
| Technology | Software development | Computer science | a |
| | | Team development | a |
| | | Software design methods | a |
| | | Software development processes | a |
| | | Web application fundamental technology | a |
| | | Frontend system development | a |
| | | Backend system development | b |
| | | Utilization of cloud infrastructure | b |
| | | SRE processes | b |
| | | Service utilization | c |

| Category | Subcategory | Skills | Importance |
|---|---|---|---|
| Technology | Digital technology | Physical computing | c |
| | | Other cutting-edge technology | c |
| | | Technology trends | c |
| Security | Security management | Security organization establishment and operation | c |
| | | Security management | c |
| | | Incident response and business continuity | c |
| | | Privacy protection | d |
| | Security technology | Secure design, development and implementation | b |
| | | Security operation, maintenance and monitoring | c |
| Personal skills | Human skills | Leadership | z |
| | | Collaboration | z |
| | Conceptual skills | Goal setting | z |
| | | Creative problem solving | z |
| | | Critical thinking | z |
| | | Adaptability | z |

[Importance key]
a High level of practical ability and expertise required
b A certain level of practical ability and expertise required
c Ability to provide an explanation required
d Understanding of positioning and relevance required
z Practical ability corresponding to role and situation is required

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# Roles of Software Engineers | Responsibilities/Main Work & Skills (2/4)

| | |
|---|---|
| **Human Resource Type** | Software Engineer |
| **Role** | **Backend engineer** |
| **Responsibilities in DX Promotion** | Take the main responsibility for mainly implementing server-side functions among software functions for providing services that leverage digital technology |
| **Main Work** | ・Understand the needs of users of services that utilize digital technology, and design and implement software with a high level of accuracy and reliability that will lead to the resolution of customers' problems<br>・Implement software functions principally on the server side in light of feedback from users, while also carrying out prototyping as needed<br>・Undertake improvements and enhancements in light of feedback from users during service operation |

**Required Skills**

| Category | Subcategory | Skills | Importance |
|---|---|---|---|
| Business transformation | Strategy/ management/ systems | Business strategy formulation and execution | d |
| | | Product management | c |
| | | Transformation management | d |
| | | Systems engineering | c |
| | | Enterprise architecture | c |
| | | Project management | b |
| | Business model/ processes | Business surveys | d |
| | | Business model design | d |
| | | Business analysis | c |
| | | Verification (business perspective) | d |
| | | Marketing | d |
| | | Branding | d |
| | Design | Customer/user understanding | c |
| | | Value discovery/definition | c |
| | | Design | d |
| | | Verification (customer/user perspective) | d |
| | | Other design technology | d |

| Category | Subcategory | Skills | Importance |
|---|---|---|---|
| Data utilization | Strategic utilization of data/AI | Data understanding/utilization | b |
| | | Data/AI utilization strategy | c |
| | | Design, implementation and evaluation of operations that utilize data/AI | c |
| | AI/data science | Mathematical statistics/multivariate analysis/data visualization | c |
| | | Machine learning/deep learning | c |
| | Data engineering | Data utilization infrastructure design | b |
| | | Data utilization infrastructure implementation/operation | b |
| Technology | Software development | Computer science | a |
| | | Team development | a |
| | | Software design methods | a |
| | | Software development processes | a |
| | | Web application fundamental technology | a |
| | | Frontend system development | b |
| | | Backend system development | a |
| | | Utilization of cloud infrastructure | a |
| | | SRE processes | b |
| | | Service utilization | b |

| Category | Subcategory | Skills | Importance |
|---|---|---|---|
| Technology | Digital technology | Physical computing | c |
| | | Other cutting-edge technology | c |
| | | Technology trends | c |
| Security | Security management | Security organization establishment and operation | c |
| | | Security management | c |
| | | Incident response and business continuity | c |
| | | Privacy protection | d |
| | Security technology | Secure design, development and implementation | b |
| | | Security operation, maintenance and monitoring | c |
| Personal skills | Human skills | Leadership | z |
| | | Collaboration | z |
| | Conceptual skills | Goal setting | z |
| | | Creative problem solving | z |
| | | Critical thinking | z |
| | | Adaptability | z |

[Importance key]
a High level of practical ability and expertise required
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d Understanding of positioning and relevance required
z Practical ability corresponding to role and situation is required

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# Roles of Software Engineers | Responsibilities/Main Work & Skills (3/4)

| | |
|---|---|
| **Human Resource Type** | Software Engineer |
| **Role** | **Cloud engineer / SRE (service reliability engineering)** |
| **Responsibilities in DX Promotion** | Take responsibility for developing the software to provide services that use digital technology, optimizing the operating environment, and increasing its reliability |
| **Main Work** | ・Understand the needs of users of services that utilize digital technology, and create software development and operating environments for the purpose of meeting user needs<br>・Optimize operating environments in light of feedback from software engineers who handle other roles<br>・Carry out continuous monitoring during service operation and, in light of the results, undertake any system- or software-related responses required to improve service reliability |

**Required Skills**

| Category | Subcategory | Skills | Importance |
|---|---|---|---|
| Business transformation | Strategy/ management/ systems | Business strategy formulation and execution | d |
| | | Product management | c |
| | | Transformation management | d |
| | | Systems engineering | c |
| | | Enterprise architecture | d |
| | | Project management | b |
| | Business model/ processes | Business surveys | d |
| | | Business model design | d |
| | | Business analysis | d |
| | | Verification (business perspective) | d |
| | | Marketing | d |
| | | Branding | d |
| | Design | Customer/user understanding | d |
| | | Value discovery/definition | d |
| | | Design | d |
| | | Verification (customer/user perspective) | c |
| | | Other design technology | d |

| Category | Subcategory | Skills | Importance |
|---|---|---|---|
| Data utilization | Strategic utilization of data/AI | Data understanding/utilization | b |
| | | Data/AI utilization strategy | c |
| | | Design, implementation and evaluation of operations that utilize data/AI | c |
| | AI/data science | Mathematical statistics/multivariate analysis/data visualization | c |
| | | Machine learning/deep learning | c |
| | Data engineering | Data utilization infrastructure design | b |
| | | Data utilization infrastructure implementation/operation | b |
| Technology | Software development | Computer science | a |
| | | Team development | b |
| | | Software design methods | b |
| | | Software development processes | b |
| | | Web application fundamental technology | b |
| | | Frontend system development | b |
| | | Backend system development | b |
| | | Utilization of cloud infrastructure | a |
| | | SRE processes | a |
| | | Service utilization | c |

| Category | Subcategory | Skills | Importance |
|---|---|---|---|
| Technology | Digital technology | Physical computing | c |
| | | Other cutting-edge technology | c |
| | | Technology trends | c |
| Security | Security management | Security organization establishment and operation | d |
| | | Security management | c |
| | | Incident response and business continuity | c |
| | | Privacy protection | d |
| | Security technology | Secure design, development and implementation | b |
| | | Security operation, maintenance and monitoring | a |
| Personal skills | Human skills | Leadership | z |
| | | Collaboration | z |
| | Conceptual skills | Goal setting | z |
| | | Creative problem solving | z |
| | | Critical thinking | z |
| | | Adaptability | z |

[Importance key]
a High level of practical ability and expertise required
b A certain level of practical ability and expertise required
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d Understanding of positioning and relevance required
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# Roles of Software Engineers | Responsibilities/Main Work & Skills (4/4)

| | |
|---|---|
| **Human Resource Type** | Software Engineer |
| **Role** | **Physical computing engineer** |
| **Responsibilities in DX Promotion** | Undertake digitalization of the real world (physical domain) and take responsibility for implementing software functions, including for devices, in the implementation of software for the provision of services utilizing digital technology |
| **Main Work** | ・Understand the needs of users of services that utilize digital technology, and design and implement software, including various devices, for the improvement of customer experience value<br>・Create software functions that acquire data and bring about effects in reality through physical devices<br>・Implement software functions in light of feedback from users, while also carrying out prototyping, including of devices, as needed<br>・Undertake improvements and enhancements in light of feedback from users during service operation |

**Required Skills**

| Category | Subcategory | Skills | Importance |
|---|---|---|---|
| Business transformation | Strategy/ management/ systems | Business strategy formulation and execution | d |
| | | Product management | c |
| | | Transformation management | d |
| | | Systems engineering | b |
| | | Enterprise architecture | d |
| | | Project management | c |
| | Business model/ processes | Business surveys | d |
| | | Business model design | d |
| | | Business analysis | d |
| | | Verification (business perspective) | d |
| | | Marketing | d |
| | | Branding | d |
| | Design | Customer/user understanding | c |
| | | Value discovery/definition | c |
| | | Design | d |
| | | Verification (customer/user perspective) | d |
| | | Other design technology | d |

| Category | Subcategory | Skills | Importance |
|---|---|---|---|
| Data utilization | Strategic utilization of data/AI | Data understanding/utilization | b |
| | | Data/AI utilization strategy | c |
| | | Design, implementation and evaluation of operations that utilize data/AI | c |
| | AI/data science | Mathematical statistics/multivariate analysis/data visualization | c |
| | | Machine learning/deep learning | c |
| | Data engineering | Data utilization infrastructure design | c |
| | | Data utilization infrastructure implementation/operation | c |
| Technology | Software development | Computer science | b |
| | | Team development | b |
| | | Software design methods | b |
| | | Software development processes | b |
| | | Web application fundamental technology | b |
| | | Frontend system development | b |
| | | Backend system development | b |
| | | Utilization of cloud infrastructure | b |
| | | SRE processes | b |
| | | Service utilization | c |

| Category | Subcategory | Skills | Importance |
|---|---|---|---|
| Technology | Digital technology | Physical computing | a |
| | | Other cutting-edge technology | c |
| | | Technology trends | c |
| Security | Security management | Security organization establishment and operation | d |
| | | Security management | c |
| | | Incident response and business continuity | c |
| | | Privacy protection | d |
| | Security technology | Secure design, development and implementation | b |
| | | Security operation, maintenance and monitoring | c |
| Personal skills | Human skills | Leadership | z |
| | | Collaboration | z |
| | Conceptual skills | Goal setting | z |
| | | Creative problem solving | z |
| | | Critical thinking | z |
| | | Adaptability | z |

[Importance key]
a High level of practical ability and expertise required
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# Chapter 3

# Human Resource Types & Roles

**a. Business Architects**

**b. Designers**

**c. Data Scientists**

**d. Software Engineers**

**e. Cyber Security**

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# What Are Cyber Security?

**Definition**

**Human resources who are responsible for measures to minimize the impact of cyber security risks in digital environments that support operational processes**

◆ **What are cyber security in the promotion of DX?**

- ✓ Efforts to ensure the security of products and services that utilize digital technology are an essential prerequisite of their rollout. Human resources who handle cybersecurity fulfill the fundamental roles in achieving this prerequisite.
- ✓ Compared with the utilization of digital technology until now, DX promotion will involve a greater number of cases in which business divisions other than IT divisions also take responsibility for security measures. It is envisaged that human resources with diverse careers will acquire the skills with which cyber security should be equipped and will play an active part in both incident prevention and the minimization of harm from any incidents that do occur.

◆ **Thinking behind the name “cyber security”**

- ✓ In these Skill Standards, the name “cyber security” has been adopted for consistency, in light of the fact that, **in security-related organizations both within Japan and overseas, measures that encompass security measures focused on information assets and digital infrastructure including OT/IoT are formulated under the term “cyber security.”**
- ✓ Of the five human resource types prescribed in the DSS-P, “cyber security” is the only type that uses the name of the field in question, rather than the person performing the work. This is because, although terms such as “security specialist” and “security professional” are used in practice as collective terms for people who handle security measures, these names conjure up the image of specialist personnel. Moreover, in light of the strong possibility that human resources who handle security measures in companies that promote DX will, in reality, also carry out other work concurrently (such as risk management or operation of digital infrastructure for the organization), **it was decided that the name should not refer to a person, in order to avoid conveying the wrong impression**.
- ✓ Thus, the “cyber security” human resource type is also **aligned with the “Plus Security” initiative** that the government is currently promoting, which seeks to encourage human resources who do not specialize in security to acquire the requisite security skills in the course of performing their assigned work.

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# What Are Cyber Security? | Expected Roles (1/2)

- The specific roles expected of cyber security and actions required of them are as follows:

### ◆ Contribute to the execution of their organization's strategy via efforts to maintain a balance between security measures and the provision of value through DX

✓ Cyber security personnel are expected to fulfill the role of providing leadership in security measures to prevent information leakage and other such harms when putting DX projects and business process re-engineering into practice. Security measures have the potential to reduce convenience and efficiency, while increasing costs, so it is not sufficient merely to strengthen security. In light of this fact, cyber security personnel must, in fulfilling this role, maintain a strong awareness of the need to maintain an appropriate balance between ensuring the requisite level of security and providing value through DX.

### ◆ Perform their assigned work as far as possible, even in situations where they hold other roles concurrently, while also utilizing specialist external cyber security providers

✓ In light of human resource trends in Japan, the DSS-P envisages that, rather than being human resources with advanced expertise who specialize in security measures, cyber security personnel will mostly be human resources who handle cyber security measures in DX promotion concurrently with other work. Due to the increasingly sophisticated nature of recent cyber attacks, the number of situations in which it is unfeasible to make appropriate judgments without a certain level of specialist skill is on the rise. Even companies that are working to bring software development in-house as part of DX promotion will find it more realistic to outsource such tasks as monitoring for anomalies, investigation of causes and penetration testing to specialist external providers. Cyber security personnel need to acquire the skill of communicating with these specialist providers, along with skills that are effective in efforts to put security measures into practice in DX promotion.

### ◆ Collaborate with other human resource types to minimize harm due to digital environment risks that arise from DX promotion

✓ It is envisaged that risks in the digital environment in DX promotion are not limited to cyber attacks, but also include a wide range of other threats, including the shutdown of social infrastructure due to the failure of control systems or IoT systems, internal misconduct within organizations and privacy infringements. Cyber security personnel are expected to address these risks in collaboration with other human resource types.

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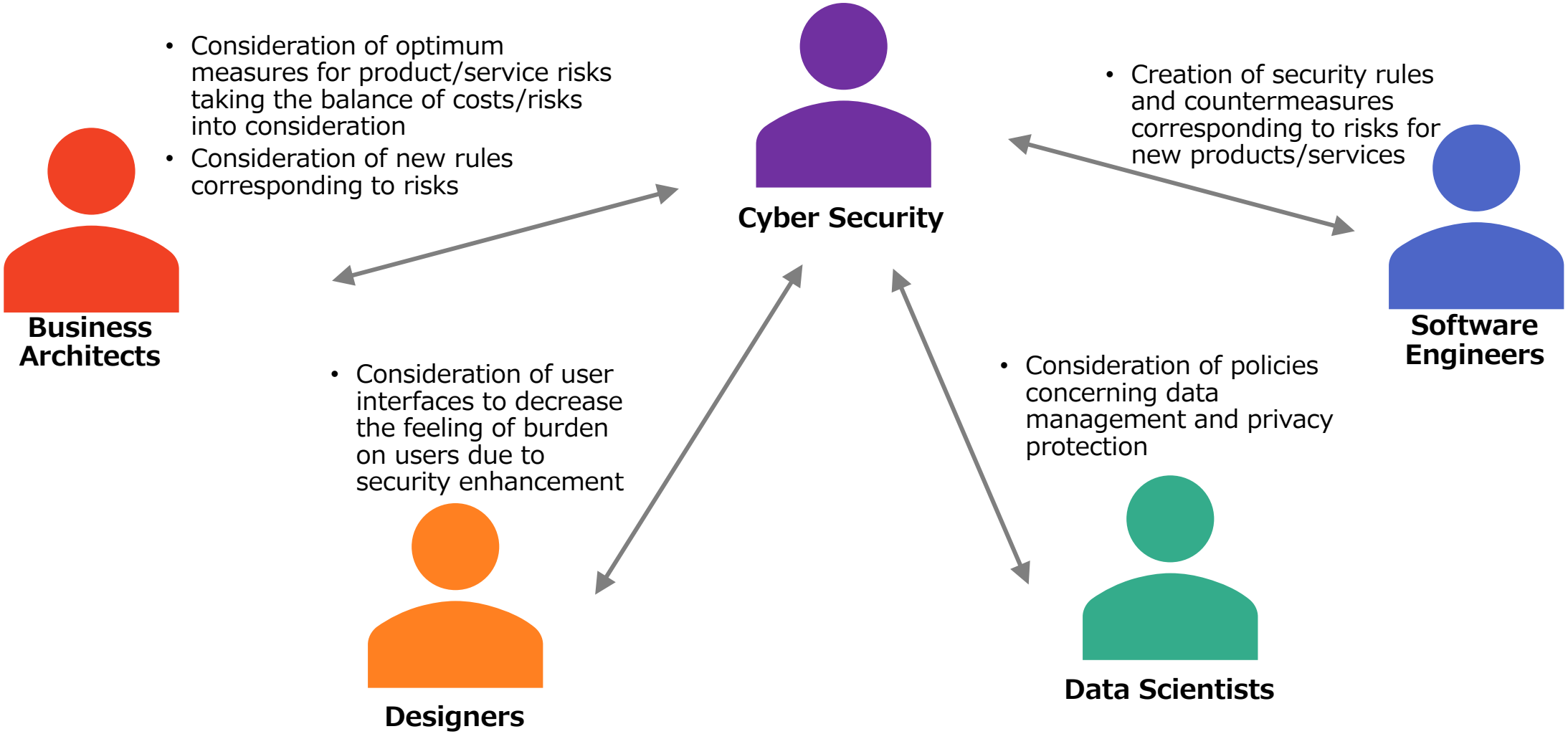
# What Are Cyber Security? | Expected Roles (2/2)

- The following shows an example of an operation in which cyber security collaborate with the other human resource types.
- The two-way arrows represent the relationships between each type, to indicate that two or more human resource types build collaborative working relationships in a range of situations, rather than being a situation in which one type issues instructions or requests to another.

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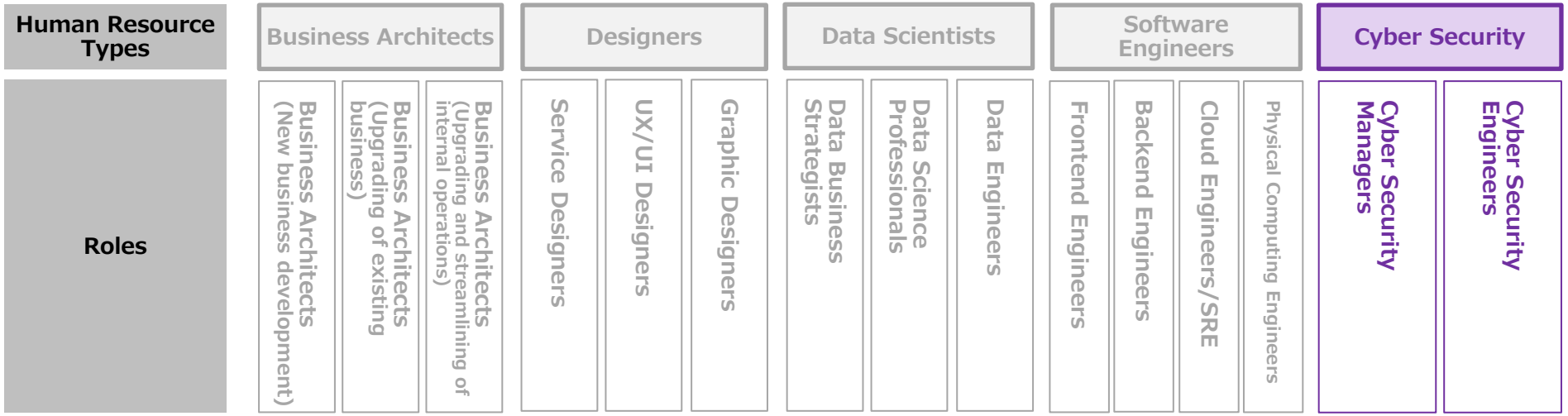
# Roles of Cyber Security




◆ **Approach to the categorization of roles**

- ✓ The cyber security type is categorized into a number of roles on the basis of differences in the work carried out.
- ✓ The roles of cyber security have been categorized into two roles, on the basis of the careers of human resources who are currently active in this realm: a management-based role and a technology-based role.
- ✓ Cyber security manager is defined as a role that principally involves the handling of such matters as the formulation, planning, management and control of policies for responding to cyber security risks that arise from DX promotion. It is also envisaged that these tasks will be handled by human resources who concurrently hold roles in a business division or risk management division of companies that are promoting DX.
- ✓ Cyber security engineer is defined as a role that principally involves the handling of such matters as the introduction, operation and maintenance of cyber security measures that arise from DX promotion. It is also envisaged that these tasks will be handled by human resources who concurrently hold roles in the IT division of companies that are promoting DX. The role names are frequently used today in job advertisements in the cyber security field.
- ✓ Regardless of the narrow sense of the term “cyber security,” these roles also involve the handling of risks such as information security, control system security and the safety of social infrastructure, as is the case in the Cybersecurity Framework published by the U.S. National Institute of Standards and Technology (NIST) and the scope of Japan’s National center of Incident readiness and Strategy for Cybersecurity (NISC).

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# Roles of Cyber Security | Approach to Skill Mapping

## Cyber security manager

- ✓ It is envisaged that the management of risks that arise from DX promotion will be divided between business architects and data business strategists, among others, in addition to human resources in this role. However, amid growing reliance on companies' digital infrastructure as a whole, not confined to DX, it is likely that it will mainly be cyber security managers who deal with risks stemming from vulnerabilities therein. Accordingly, cyber security managers need to have **not only skills associated with cyber security, but also a broad understanding of such matters as approaches to business transformation and data utilization, which are the goals of DX**, in order to recognize, identify and respond to risks that arise from DX promotion.
- ✓ Moreover, as it is necessary to position activities associated with DX promotion within the organization's risk management system and to ensure consistency and coordination with existing risk measures, cyber security managers are required to acquire knowledge and skills associated with risk management, business continuity and incident response.
- ✓ In addition to these skills, given the need for ESG (environmental, social, and corporate governance) efforts in companies and the like, cyber security managers require communication skills to fulfill their duty of accountability to relevant parties associated with cyber security measures, as part of the governance element.

## Cyber security engineer

- ✓ As DX often involves the utilization of advanced technologies, hitherto-unprecedented risks may be actualized in the form of incidents or signs thereof. Accordingly, cyber security engineers need to acquire the skills required to **continuously gather information and identify the latest trends in the technology used in DX promotion, and also to understand the content thereof**, in order to be able to avoid, as far as possible, such risks turning into unforeseen situations.
- ✓ In carrying out the assigned work of a cyber security engineer, human resources in this role will often need to collaborate with other roles in relation to such matters as measures to combat vulnerabilities in digital infrastructure and services, and the protection of privacy in data. Accordingly, cyber security engineers must **acquire corresponding skills in interdisciplinary fields at a level that enables them to put their skills into practice** when engaging in such collaboration.
- ✓ Putting security measures into practice requires the introduction of measures that take into account the balance with convenience, after the situations in which the technology will be used have been envisaged. Accordingly, cyber security engineers need to acquire basic knowledge and skills related to the goals of DX promotion and usage situations.

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# Roles of Cyber Security | Responsibilities/Main Work & Skills (1/2)

**Human Resource Type**

Cyber Security

**Role**

## Cyber security manager

**Responsibilities in DX Promotion**

In the formulation of business plans to increase customer value, consider and evaluate cyber security risks resulting from the use of digital technology and take the lead in the management and control of measures to limit the impact in order to contribute to increase sense of trust in the business as one that provides high customer value

**Main Work**

- Assess risks associated with cyber security, safety and privacy protection that arise through the utilization of digital technology in a new business
- In light of the risk-return balance, consider strategies for minimizing the impact of cyber security risks, and the implementation structure of measures
- Manage and audit the implementation status of measures to minimize cyber security risks
- Respond to cyber security incidents that arise in digital environments that are used to conduct business

**Required Skills**

| Category | Subcategory | Skills | Importance |
|---|---|---|---|
| Business transformation | Strategy/ management/ systems | Business strategy formulation and execution | b |
| | | Product management | c |
| | | Transformation management | b |
| | | Systems engineering | c |
| | | Enterprise architecture | c |
| | | Project management | b |
| | Business model/ processes | Business surveys | c |
| | | Business model design | c |
| | | Business analysis | c |
| | | Verification (business perspective) | c |
| | | Marketing | c |
| | | Branding | c |
| | Design | Customer/user understanding | c |
| | | Value discovery/definition | c |
| | | Design | c |
| | | Verification (customer/user perspective) | c |
| | | Other design technology | c |

| Category | Subcategory | Skills | Importance |
|---|---|---|---|
| Data utilization | Strategic utilization of data/AI | Data understanding/utilization | b |
| | | Data/AI utilization strategy | b |
| | | Design, implementation and evaluation of operations that utilize data/AI | b |
| | AI/data science | Mathematical statistics/multivariate analysis/data visualization | c |
| | | Machine learning/deep learning | c |
| | Data engineering | Data utilization infrastructure design | c |
| | | Data utilization infrastructure implementation/operation | c |
| Technology | Software development | Computer science | c |
| | | Team development | d |
| | | Software design methods | c |
| | | Software development processes | d |
| | | Web application fundamental technology | d |
| | | Frontend system development | d |
| | | Backend system development | d |
| | | Utilization of cloud infrastructure | b |
| | | SRE processes | c |
| | | Service utilization | c |

| Category | Subcategory | Skills | Importance |
|---|---|---|---|
| Technology | Digital technology | Physical computing | c |
| | | Other cutting-edge technology | c |
| | | Technology trends | c |
| Security | Security management | Security organization establishment and operation | a |
| | | Security management | a |
| | | Incident response and business continuity | a |
| | | Privacy protection | a |
| | Security technology | Secure design, development and implementation | b |
| | | Security operation, maintenance and monitoring | b |
| Personal skills | Human skills | Leadership | z |
| | | Collaboration | z |
| | Conceptual skills | Goal setting | z |
| | | Creative problem solving | z |
| | | Critical thinking | z |
| | | Adaptability | z |

[Importance key]
a High level of practical ability and expertise required
b A certain level of practical ability and expertise required
c Ability to provide an explanation required
d Understanding of positioning and relevance required
z Practical ability corresponding to role and situation is required

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# Roles of Cyber Security | Responsibilities/Main Work & Skills (2/2)

| | |
|---|---|
| **Human Resource Type** | Cyber Security |
| **Role** | **Cyber Security Engineer** |
| **Responsibilities in DX Promotion** | Implement, maintain, and run measures to limit cyber security risks relating to the use of digital technology in business in order to contribute to the stable provision of business offering high customer value |
| **Main Work** | ・Introduce and implement security products and services compatible with technical management measures for the minimization of the impacts of digital-related risks<br>・Operate and maintain security products and services<br>・Conduct change management associated with cyber security in regard to such matters as systems, services and settings related to the utilization of digital technology<br>・Conduct performance evaluations and vulnerability response management related to the utilization of digital technology |

**Required Skills**

| Category | Subcategory | Skills | Importance |
|---|---|---|---|
| Business transformation | Strategy/ management/ systems | Business strategy formulation and execution | c |
| | | Product management | c |
| | | Transformation management | c |
| | | Systems engineering | c |
| | | Enterprise architecture | c |
| | | Project management | c |
| | Business model/ processes | Business surveys | d |
| | | Business model design | d |
| | | Business analysis | d |
| | | Verification (business perspective) | d |
| | | Marketing | d |
| | | Branding | d |
| | Design | Customer/user understanding | d |
| | | Value discovery/definition | d |
| | | Design | d |
| | | Verification (customer/user perspective) | d |
| | | Other design technology | d |

| Category | Subcategory | Skills | Importance |
|---|---|---|---|
| Data utilization | Strategic utilization of data/AI | Data understanding/utilization | c |
| | | Data/AI utilization strategy | c |
| | | Design, implementation and evaluation of operations that utilize data/AI | c |
| | AI/data science | Mathematical statistics/multivariate analysis/data visualization | c |
| | | Machine learning/deep learning | c |
| | Data engineering | Data utilization infrastructure design | c |
| | | Data utilization infrastructure implementation/operation | c |
| Technology | Software development | Computer science | b |
| | | Team development | b |
| | | Software design methods | b |
| | | Software development processes | b |
| | | Web application fundamental technology | b |
| | | Frontend system development | b |
| | | Backend system development | b |
| | | Utilization of cloud infrastructure | a |
| | | SRE processes | a |
| | | Service utilization | b |

| Category | Subcategory | Skills | Importance |
|---|---|---|---|
| Technology | Digital technology | Physical computing | b |
| | | Other cutting-edge technology | b |
| | | Technology trends | c |
| Security | Security management | Security organization establishment and operation | b |
| | | Security management | c |
| | | Incident response and business continuity | b |
| | | Privacy protection | b |
| | Security technology | Secure design, development and implementation | a |
| | | Security operation, maintenance and monitoring | a |
| Personal skills | Human skills | Leadership | z |
| | | Collaboration | z |
| | Conceptual skills | Goal setting | z |
| | | Creative problem solving | z |
| | | Critical thinking | z |
| | | Adaptability | z |

[Importance key]
a High level of practical ability and expertise required
b A certain level of practical ability and expertise required
c Ability to provide an explanation required
d Understanding of positioning and relevance required
z Practical ability corresponding to role and situation is required

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# Chapter 4

# Commentary on the List of Common Skills

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# Skills in the “Business Transformation” Category

## Structure and approach

- The skills in the “business transformation” category consist of the three subcategories “strategy/management/systems,” “business model/processes” and “design.”
- The approach to each subcategory is as follows:

(Strategy/management/systems)

- ✓ Skills required to bring about digital transformation
- ✓ **Skills that are important** not only for DX promotion associated with individual products and services, but also **to support DX promotion throughout the organization/company** to lay the foundation for this

(Business model/processes)

- ✓ **Skills focused on driving the process of DX promotion associated with individual products and services**
  - ➢ These skills are defined for each process involved in driving individual initiatives (particularly new business and the upgrading of business) from the **business perspective**

(Design)

- ✓ **Skills focused on driving the process of DX promotion associated with individual products and services**
  - ➢ These skills are defined for each process involved in driving individual initiatives (particularly new business development) from the **customer perspective**

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# Skills in the “Data Utilization” Category (1/3)

## Structure and approach

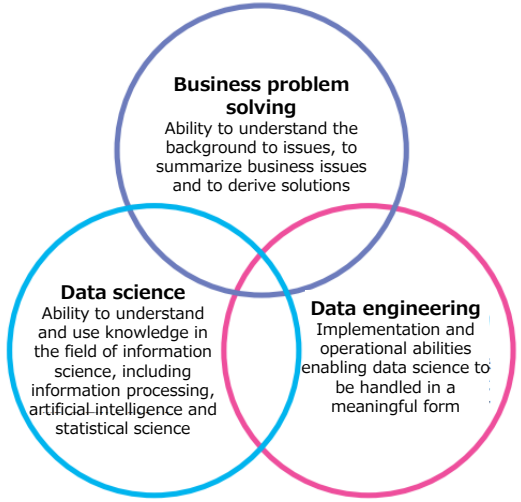
- The skills in the “data utilization” category consist of the three subcategories “strategic utilization of data/AI,” “AI/data science” and “data engineering.”
- **Strategic utilization of data/AI** skills are defined as everything from skills associated with the understanding and utilization of data/AI to those associated with the formulation and achievement of strategies related to the utilization of data/AI.
- **AI/data science** skills are defined as skills associated with AI/data science that employ data analysis.
- **Data engineering** skills are defined as skills associated with the design, creation and operation of systems that provide the infrastructure for data utilization.

⏩The learning subject examples described for each of the aforementioned categories have been selected with reference to the **Japan DataScientist Society’s Skills Checklist***. The pages that follow show how the aforementioned categories correspond to the Skills Checklist.

**<Reference> The Japan DataScientist Society Skills Checklist**

- Compiled by the Japan DataScientist Society’s Skill Definition Committee, this provides a list—systematically organized by field—of the skills required to play an active role as a data scientist.
- Outlining the skill set required of data scientists, the checklist defines three fields and sets out the skills required in each.
- To facilitate confirmation of the status of skill acquisition, it has been prepared in the form of a checklist using expressions such as “Can explain...” and “Can do....”
- The skills in the checklist are ranked by level from ★ (Assistant Data Scientist) to ★★★★ (Senior Data Scientist). Here, the main focus is on items ranked ★★ (Associate Data Scientist).
- A list of AI utilization skills has been compiled from skills extracted from three areas.

*Skills Checklist ver.5 was used in formulating the DSS-P; it can be viewed in Excel format at the following URL: https://www.datascientist.or.jp/common/docs/skillcheck_ver5.00_simple.xlsx




**(Source) IPA, “Skill Checklist & Task list Overview” (https://www.ipa.go.jp/jinzai/skill-standard/plus-it-ui/itssplus/ps6vr70000001ity-att/000083733.pdf)**

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# Skills in the “Data Utilization” Category (2/3)

## Structure of the “strategic utilization of data/AI” subcategory

- “Strategic utilization of data/AI” is composed of the following skills.
  - ✓ **Data understanding/utilization:** Skills to accurately understand the results of data analysis that applies graphs, diagrams and other statistical information, along with various analytical techniques, and to gain deep insights into the meaning and background thereof
  - ✓ **Data/AI utilization strategy:** Skills to propose problem solving methods and new business models that utilize data/AI, in light of business strategy, organizational challenges, customer needs and the like
  - ✓ **Design, implementation and evaluation of operations that utilize data/AI:** Skills to design an approach aimed at achieving the goals of the data/AI strategy, and then to implement and continuously improve data/AI analysis mechanisms on the front line

## Structure of the “AI/data science” subcategory

- “AI/data science” is composed of the following skills.
  - ✓ **Mathematical statistics/multivariate analysis/data visualization:** Skills to use techniques based on statistical knowledge to analyze data and gain insights from the results
  - ✓ **Machine learning/deep learning:** Skills to create and evaluate appropriate models by using techniques including, machine learning, deep learning, natural language processing, image recognition, speech recognition and the like

## Structure of the “data engineering” subcategory

- “Data engineering” is composed of the following skills.
  - ✓ **Data utilization infrastructure design:** Skills to finalize the requisite system environment and requirements for collected data and tables, etc. in preparing data utilization infrastructure that generates output from data
  - ✓ **Data utilization infrastructure implementation/operation:** Skills to implement data utilization infrastructure that generates output from data, and to handle the data required to smoothly and effectively operate the infrastructure

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# Skills in the “Data Utilization” Category (3/3)

**[Reference]** The tables below show how the skills in the “data utilization” category of the List of Common Skills correspond to the skill categories/subcategories in the Japan DataScientist Society’s Skills Checklist.

**<List of Common Skills: “Data utilization” category>** ⟷ **<The Japan DataScientist Society: Skills Checklist>**

| Category | Subcategory | Skill |
|---|---|---|
| Data utilization | Strategic utilization of data/AI | Data understanding/utilization |
| | | Data/AI utilization strategy |
| | | Design, implementation and evaluation of operations that utilize data/AI |
| | AI/data science | Mathematical statistics/multivariate analysis/data visualization |
| | | Machine learning/deep learning |
| | Data engineering | Data utilization infrastructure design |
| | | Data utilization infrastructure implementation/operation |

As a general rule, the learning subject examples in the “data utilization” category of the List of Common Skills describe the skill categories/subcategories in the Japan DataScientist Society’s Skills Checklist, on the basis of the format shown below.

- Skill category 1 (subcategory 1, subcategory 2,...)
- Skill category 2 (subcategory 1, subcategory 2,...)

**Business problem solving**

| Skill category | Subcategory |
|---|---|
| Standards of conduct | Business-mindedness |
| | Data/AI ethics |
| | Compliance |
| Logical thinking | MECE |
| | Structuring ability |
| | Verbalization ability |
| | Storylining |
| | Documentation |
| | Explanation ability |
| Ideas/design | Ideas |
| | Design |
| | Consideration of AI utilization |
| | Decisions on disclosure/nondisclosure |
| Definition of challenges | KPIs |
| | Scoping |
| | Value estimation |
| Approach design | Data acquisition |
| | AI-ready |
| | Approach design |
| | Analysis approach design |
| | Generative AI utilization |
| Data understanding | Correct understanding of statistical information |
| | Understanding from business perspective |
| | Extraction of meaning/insights |
| Analytical evaluation | Evaluation |
| | Feedback into operations |
| Implementation in business | Implementation |
| | Evaluation/improvement mechanisms |
| Contracts and protection of rights | Contracts |
| | Protection of rights |
| Project management | Project launch |
| | Project planning |
| | Operation |
| | Horizontal deployment |
| | Policy change |
| | Completion |
| | Resource management |
| | Risk management |
| Organization management | Training/knowledge sharing |
| | Organization management |

**Data engineering**

| Skill category | Subcategory |
|---|---|
| Environment creation | System planning |
| | System design |
| | Architecture design |
| Data collection | Client technology |
| | Communications technology |
| | Data extraction |
| | Data collection |
| | Data integration |
| Data structure | Basic knowledge |
| | Definition of requirements |
| | Table definition |
| | Table design |
| Data storage | DWH |
| | Distributed technology |
| | Cloud |
| | Real-time processing |
| | Cache technology |
| | Data storage technology |
| | Search technology |
| Data processing | Filtering |
| | Sorting |
| | Joining |
| | Preprocessing |
| | Mapping |
| | Sampling |
| | Aggregation |
| | Conversion/computation |
| Data sharing | Data output |
| | Data decompression |
| | Data linkage |
| Programming | Basic programming |
| | Extension programming |
| | Generative AI utilization |
| | Coding assistance |
| | Algorithms |
| | Analysis programs |
| | SQL |
| IT security | Basic knowledge |
| | Privacy |
| | Attacks and defensive techniques |
| | Encryption technology |
| | Authentication |
| | Blockchain |
| | Zero trust |
| AI system operation | AutoML |
| | MLOps |
| | AIOps |
| Generative AI | Prompt engineering |
| | Coding assistance |
| | Fine-tuning |
| | Generative AI`s tech. utilization |
| | Generative AI development |

**Data science**

| Skill category | Subcategory |
|---|---|
| Numerical understanding | Basic linear algebra |
| | Basic calculus |
| | Basic set theory |
| Basic scientific analysis | Basic statistical mathematics |
| | Insights |
| | Properties/relationships |
| | Estimation/testing |
| | Association analysis |
| | Causal inference |
| Data understanding/ verification | Data checking |
| | High level overview/meta thinking |
| | Data understanding |
| | Data granularity |
| Data preparation | Sampling |
| | Data cleansing |
| | Data processing |
| | Feature engineering |
| Data visualization | Definition of direction |
| | Axis selection |
| | Data processing |
| | Expression/implementation techniques |
| | Extraction of meaning |
| Modeling | Regression/classification |
| | Statistical evaluation |
| Modeling | Machine learning |
| | Deep learning |
| | Reinforcement learning |
| Modeling | Time series analysis |
| | Clustering |
| | Graphical model |
| | Network analysis |
| Model utilization | Anomaly detection |
| | Recommend |
| Unstructured data processing | Natural language processing |
| | Image recognition |
| | Video recognition |
| | Speech recognition |
| Generate | Large language model |
| | Image generation model |
| | Audio generative model |
| Operations research | Simulation/data assimilation |
| | Optimization |

Of the skill categories/subcategories in the Skills Checklist, those in the gray cells are not included in the “data utilization” category, because they are defined in categories other than the “data utilization” category in the List of Common Skills.

(Source) The Japan DataScientist Society Skills Checklist ver.5

# Skills in the “Technology” Category (1/2)

## Structure and approach

- The skills in the “technology” category consist of the two subcategories “software development” and “digital technology.”
- Whereas **“software development”** skills are defined as **basic skills required for the implementation, introduction and operation of products and services that utilize digital technology**, **“digital technology”** skills are defined as **applied skills required when dealing with specific fields, namely physical computing and other cutting-edge technology**.

## Structure of the “software development” subcategory

- This subcategory is composed of the following skills, classified under the headings “basic software development,” “web application development,” and “infrastructure/operation.”
  - Basic software development
    - ✓ **Computer science:** Skills related to data structure and algorithms, etc. required in software development
    - ✓ **Team development:** Skills required to increase the productivity of team-based software development
    - ✓ **Software design methods:** Skills to consider data structure and internal architecture in order to implement software in accordance with the objectives, and to apply these to the design
    - ✓ **Software development processes:** Skills to manage development plans, quality and other such matters in software development
  - Web application development
    - ✓ **Web application fundamental technology:** Basic skills required to design and develop web applications
    - ✓ **Frontend system development:** Skills to design and develop screens that serve as the direct interface for users
    - ✓ **Backend system development:** Skills to design and develop server-side functions that are not visible to users

(Continued on next page)

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# Skills in the “Technology” Category (2/2)

## Structure of the “software development” subcategory

- (Continued from previous page)
  - Infrastructure/operation
    - ✓ **Utilization of cloud infrastructure:** Skills to design and develop server-side functions that are not visible to users
    - ✓ **SRE processes:** Skills to aim for cooperation between development and operation in order to achieve improved release cycles and service stability
    - ✓ **Service utilization:** Skills to carry out data linkage and system linkage to other internal systems, including core systems, and to external services

## Structure of the “digital technology” subcategory

- “Digital technology” is composed of the following skills.
  - ✓ **Physical computing:** Skills to digitalize and handle physical phenomena by using sensors, robots and IoT conversion of existing devices
  - ✓ **Other cutting-edge technology:** Knowledge concerning implementation technologies other than those listed above and implementation technologies with few examples of application*
  - ✓ **Technology trends:** Knowledge concerning businesses and services that apply new digital technologies*

*The learning subject examples “other cutting-edge technology” and “technology trends” are provided as illustrative examples and should be learned as needed

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# Skills in the “Security” Category

## Structure and approach

- The skills in the “security” category consist of the two subcategories “security management” and “security technology.”
- Whereas **“security management”** skills are defined as **skills associated with management systems, from the planning and consideration of security measures to their operation and review** in the course of DX promotion, **“security technology”** skills are defined as **skills associated with technical elements that must be understood specifically in the implementation of security measures** in digital environments.

## Structure of the “security management” subcategory

- “Security management” is composed of the following skills.
  - ✓ **Security organization establishment and operation:** Skills to establish organizations for implementing security measures and to facilitate their maintenance and operation (including securing and cultivating key personnel), and skills to undertake activities that foster an organization-wide security culture within the company
  - ✓ **Security management:** Skills to appropriately implement security management processes relating to such matters as information, cyber space and OT/IoT environments
  - ✓ **Incident response and business continuity:** Skills to minimize impacts and enable business continuity in the event that risks (cyber attacks, loss, internal misconduct, disaster, failure, etc.) become actualized as security incidents in the course of digital usage
  - ✓ **Privacy protection:** Skills to understand requirements for the protection of personal data and other privacy-related information and to put them into practice

## Structure of the “security technology” subcategory

- “Security technology” is composed of the following skills.
  - ✓ **Secure design, development and implementation:** Skills to carry out design, development and implementation on the basis of the policy on measures to make the organization less susceptible to cyber attacks or misconduct of various kinds when planning and designing digital products and services, and skills to understand the vulnerabilities of digital products and services and to appropriately conduct diagnosis in practice (including by means of outsourcing)
  - ✓ **Security operation, maintenance and monitoring:** Skills to appropriately practice maintenance and measures in order to securely operate digital services, and skills to appropriately practice such tasks as security monitoring and investigation of the causes of security incidents

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# Skills in the “Personal Skills” Category

## Structure and approach

- The skills in the “personal skills” category consist of the two subcategories “human skills” and “conceptual skills.”
- The approach to each subcategory is as follows:

  (Human skills)

  - ✓ Required as **interpersonal relationship skills** that human resources who promote DX should have, these are skills to create teams and collaborate in working toward a goal while forming a consensus with members who have diverse values

  (Conceptual skills)

  - ✓ Required as **thinking skills** when driving the DX promotion process, these are skills for the purpose of thinking about how to set a goal, what solution should be developed for the problem and how to make decisions

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# Chapter 5

# How the DSS-P Can Be Utilized

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# Examples of Utilization

- Assuming four main user groups (organizations or companies/individuals/training providers/human resources service companies), below are example usages and specific details for each user group.

| | Example user | How the DSS-P can be utilized | Specific utilization examples |
|---|---|---|---|
| **Organizations/ companies** | • Director who wants to undertake initiatives to promote DX<br>• Organization that wants to develop human resources who promote DX (company HR department)<br>• Organization that wants to recruit human resources who promote DX (company HR department, employment agency, etc.) | • In reflection on the changes in society, define both, a strategy for promoting DX required at one's company as well as **a human resources strategy in the digital area** that meets the skill standards<br>• In reference to the skill standards, **undertake initiatives to recruit the human resources required for DX promotion at one's company** | • As part of the human resources strategy in the digital area, **define the roles expected** of such human resources according to the company's situation while referencing the skill standards<br>• In reference to the skill standards, **visualize the extent of the lack** of human resources with skills and knowledge required for DX promotion<br>• **Conduct a review of the in-house training lineup** in reference to skills and learning subject examples in order to develop the required human resources<br>• **Create a job description** in reference to role definitions, skills and learning subject examples in order to recruit the required human resources |
| **Individuals** | • Individuals assigned to in-house DX promotion projects<br>• Individuals aiming for a career in DX promotion | • **Use the Skill Standard as guidelines to check the required knowledge and skills** based on the direction of DX at the relevant organization or company, and the relevant individual's career<br>• **With a vision for practical use** in one's own work or career, **participate in classes with relevant training content** | • In reference to the Skill Standard, **consider what role you should aim for, and which role in the Skill Standard the current role is close to**<br>• In reference to learning subject examples, gather information on training content (e.g.: visit the IPA's MANABI-DX (deluxe)) course guidance portal, or check the relevant company's in-house training content), and **select and learn content** relating to the required knowledge and skills |
| **Training providers** | • Company that provides learning content | • **Set out the required learning subjects** for skill acquisition, and provide **opportunities for explanation, output, and practical use of** this for organizations, companies, and individuals | • Set out the learning subjects required for acquiring knowledge **and skills, and provide training content that prioritize enhancing the learning effect** (e.g.: implementation of tests to confirm the degree to which learning has taken root, provision of training in a range of forms such as workshops and opportunities to put it into practice, etc.) |
| **Human resources service companies** | • Company that provides services related to securing human resources who promote DX | • In reference to the skill standards, **provide support** to organizations and companies **in securing human resources** | • In reference to the skill standards, **define human resource requirements and required skills** in order to secure the necessary human resources<br>• Conduct a research on the market of human resources that are necessary to promote DX based on the skill standards and provide information on the **human resource market trends** to organizations and companies |

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