Overview

The Digital Skill Standards
ver.1.0

December 2022

Information-technology Promotion Agency

Ministry of Economy, Trade and Industry

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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[1]).
- 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: DSS-L (Digital Skill Standards for DX literacy) that provides guidelines for all business persons to equip themselves with the fundamental knowledge, skills, and mind required for DX, and DSS-P (Digital Skill Standards for DX Promotion) that provides guidelines for companies to recruit and develop human resources with expertise to promote DX.
  - ✓ DSS-L (Digital Skill Standards for DX literacy) : A standard for skills that all business persons should equip themselves with
  - ✓ DSS-P (Digital Skill Standards for DX Promotion) : A standard for the roles and required skills for the human resources 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 company or organization, it must be specifically tailored to the direction of the industry that the relevant company or organization belongs to, and the company or organization's own business.
- IPA will work on the dissemination and utilization of the Digital Skill Standards with the involvement of a range of players in the private sector in collaboration with the relevant ministries and agencies, and will continuously review the standard while obtaining feedback from users.

1. 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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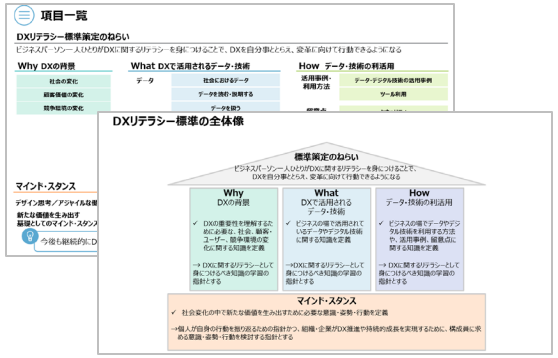
Structure of the Digital Skill Standards

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

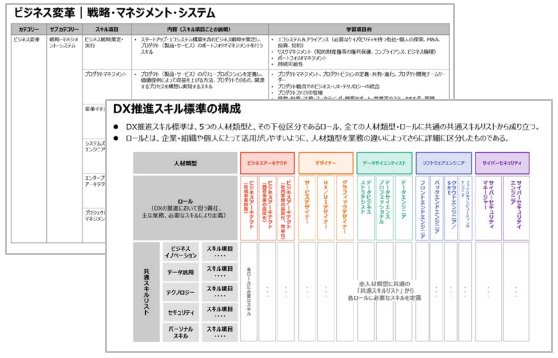
The Digital Skill Standards

DSS-L (Digital Skill Standards for DX literacy)



- 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, attitude, and actions required of the persons who constitute it

DSS-P (Digital Skill Standards for DX Promotion)



- 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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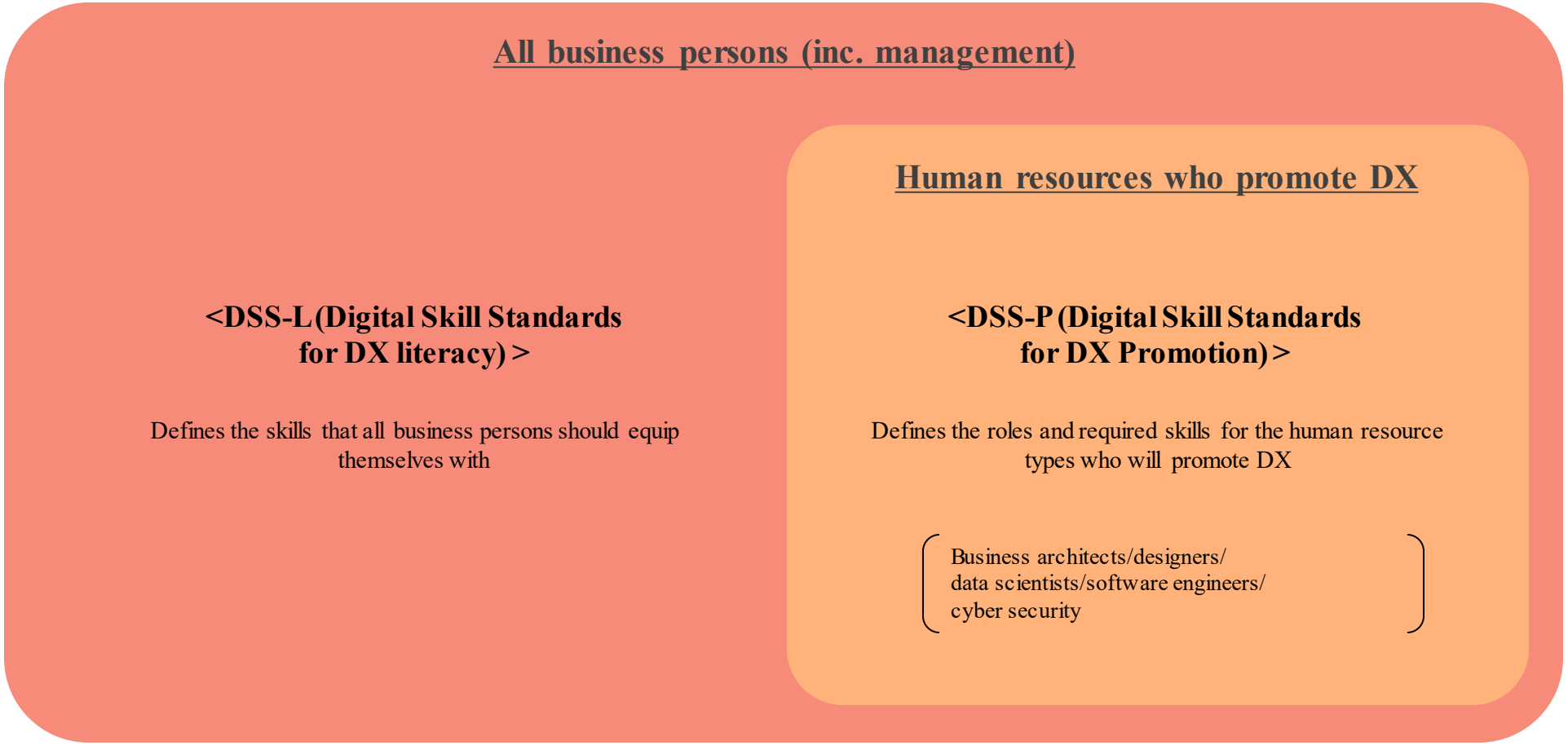
Human Resources for whom the Digital Skill Standards Is Intended

- 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, DSS-L (Digital Skill Standards for DX literacy) is intended for all business persons, while DSS-P (Digital Skill Standards for DX Promotion) is intended for human resources who have expertise and will undertake DX initiatives at a company or organization (the human resources who promote DX).



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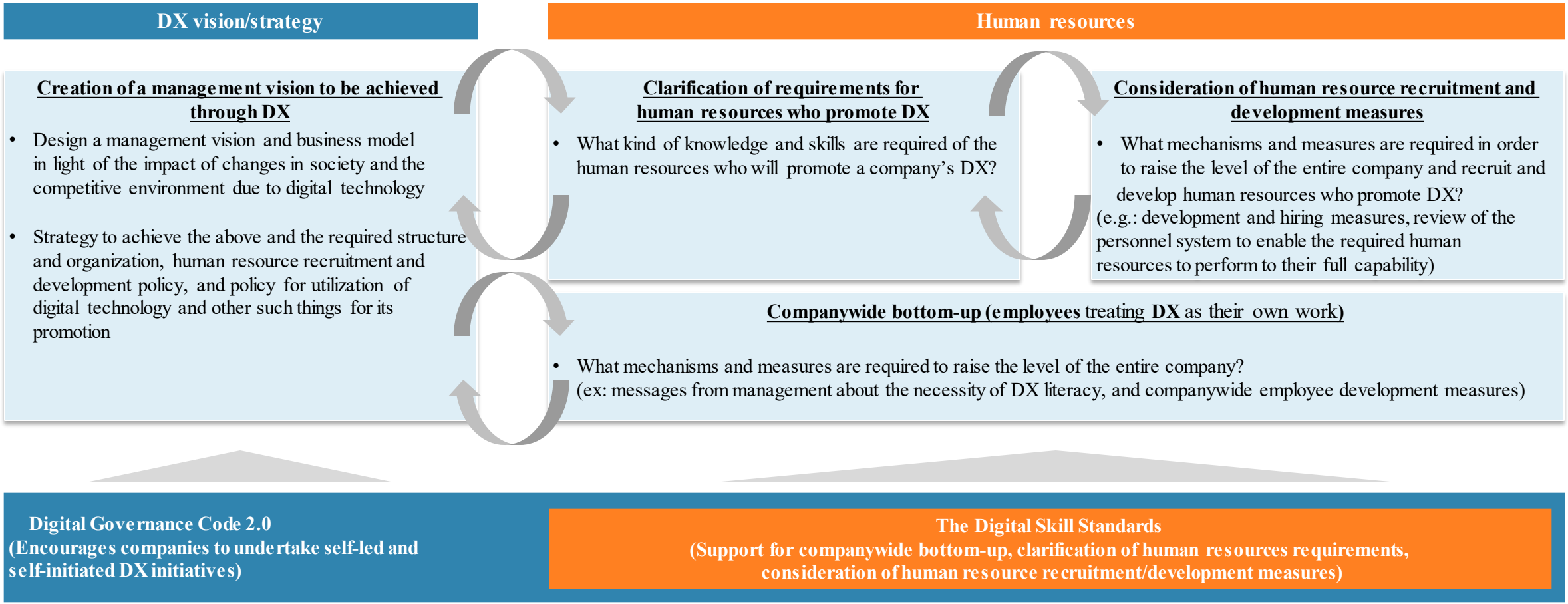
How the Digital Skill Standards Can Be Utilized

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



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The Aim of DSS-L (Digital Skill Standards for DX literacy)

The aim of DSS-L (Digital Skill Standards for DX literacy)

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 companies and organizations, 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.
- ✓ DSS-L (Digital Skill Standards for DX literacy) is a set of learning guidelines that lays out the mind 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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Overview of DSS-L (Digital Skill Standards for DX literacy)

Aim of the standard

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

Mind and Stance

- ✓ Define the mindset, attitude, 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, attitude, and actions required of the persons who constitute it in order to promote DX and achieve continuous growth

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DSS-L (Digital Skill Standards for DX literacy) - List of Items

The aim of DSS-L (Digital Skill Standards for DX literacy)

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 methods	Example uses of data and digital technology
	Use of tools
Points for attention	Security
	Moral issues
	Compliance

Mind and Stance

Design thinking/agile working style	Empathy with customers and users	Out-of-the-box thinking	Iterative approach	
Mind 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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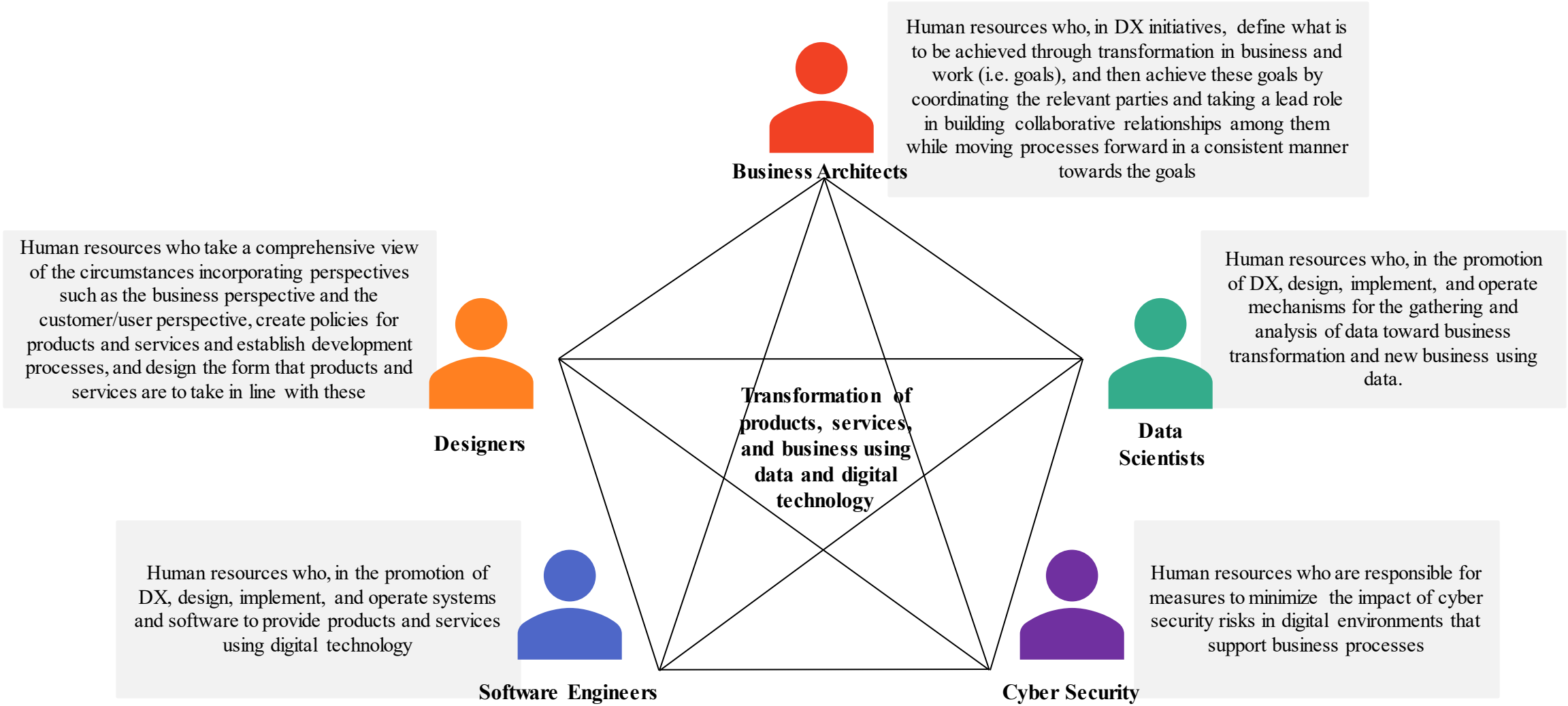
DSS-P (Digital Skill Standards for DX Promotion) - Definition of Human Resource Types

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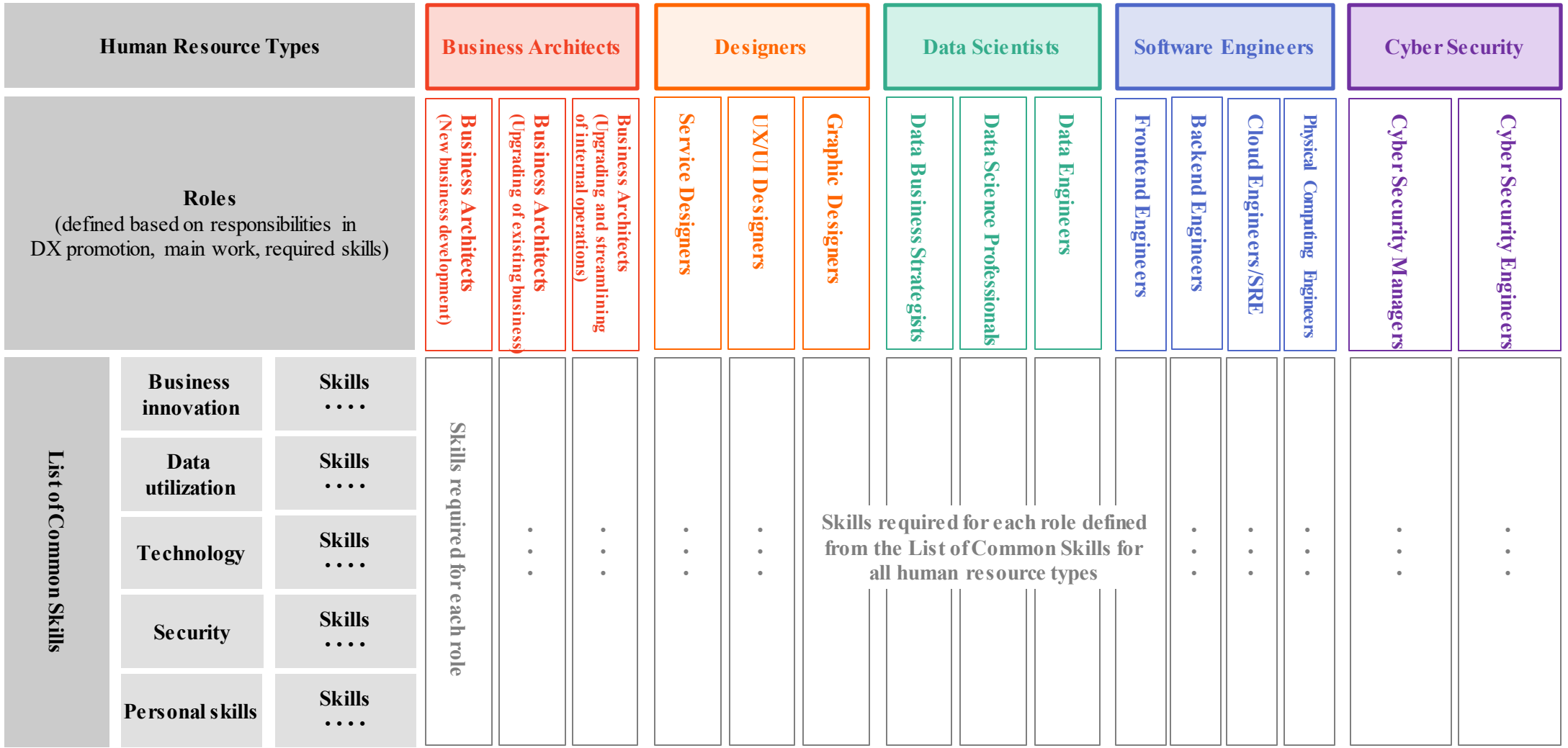
DSS-P (Digital Skill Standards for DX Promotion) -Structure

- DSS-P (Digital Skill Standards for DX Promotion) 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 companies, organizations, and individuals.



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DSS-P (Digital Skill Standards for DX Promotion) – 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 • Definition of requirements for development based on customer needs, and software architecture design • Determination of priority in development	• Development, evaluation, and verification of products/services considering design guidelines, usability, ethical appropriateness	• Consideration of new mechanisms for collecting/accumulating/ana-lyzing/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 • 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	

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DSS-P (Digital Skill Standards for DX Promotion) - List of Roles

- DSS-P (Digital Skill Standards for DX Promotion) further subdivides human resource types into the roles described below.

Human Resource Types	Role	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 reflection upon 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[2], 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

2. 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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DSS-P (Digital Skill Standards for DX Promotion) - 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 creation 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 techniques
		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 construction and operation
		Security management
		Incident response and business continuity
		Privacy protection
	Security technology	Secure design, development, and construction
		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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DSS-P (Digital Skill Standards for DX Promotion) - (Example) The Role of Data Scientists | Responsibilities/Main Work & Skills

Human resource types	Data Scientists
Role	**Data Science Professionals**
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 • 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 • Creation of mechanism for data utilization in front-line departments, education and support for end users • Improvement of analysis models in reflection on the operating state of mechanisms for data utilization and new business demands • 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 creation 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 techniques	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 construction and operation	d
		Security management	c
		Incident response and business continuity	c
		Privacy protection	b
	Security technology	Secure design, development, and construction	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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How The Standard Can Be Used

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

	Example users	How the standard can be used	Specific utilization example
Organizations/ companies	• Director who wants to undertake initiatives to promote DX • Organization that wants to develop human resources to promote DX (company HR department) • Organization that wants to recruit human resources to promote DX (company HR department, employment agency, etc.)	• In reflection on changes in society, create a strategy for promoting DX required by the relevant company, and in reference to skill standards, **undertake initiatives to recruit the human resources required for DX promotion at the relevant company**	• In reference to the skill standard, **visualize the extent of the lack** of human resources with skills and knowledge required for DX promotion • **Conducting a review of the in-house training lineup** in reference to skills and learning subject examples in order to develop the required human resources • **Creating a job description** in reference to role definitions, skills, and learning subject examples in order to recruit the required human resources
Individual	• Individuals assigned to in-house DX promotion projects • 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 • **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** • 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.)

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Initiatives toward Future Utilization and Dissemination of the Digital Skill Standards

- IPA will work on **the dissemination and utilization** of the Digital Skill Standards after its release **with the involvement of a range of players in the private sector** in collaboration with the relevant ministries and agencies, and will **continuously review** the Digital Skill Standards while obtaining **feedback from users**.

1 **Enrichment of education content for development of human resources for DX promotion**

☐ **MANABI-DX(deluxe)** content to be linked to the Digital Skill Standards when published

☐ Enriched **educational content** for acquiring skills to meet the Digital Skill Standards

2 **Measures for dissemination of the Digital Skill Standards**

☐ Information dissemination by **experts (investigatory committee) and promotion groups**

☐ **Collaborating** with **users (industries working on DX, etc.)**

3 **Continuous update and enrichment of the Digital Skill Standards**

☐ Understanding of utilization examples and feedback from users (industries working on DX, etc.)

☐ Continuous review based on technology trends and market changes

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(Reference) DSS-P (Digital Skill Standards for DX Promotion) Investigatory Organization

- The Information-technology Promotion Agency (IPA) assembled a forum of experts that included experts in each human resources type, and held numerous considerations and discussions of the skills for each human resources type. This was then compiled by the Ministry of Economy, Trade and Industry's Investigatory Committee for Human Resources Policy in the Digital Age as the Version 1.0 of the Digital Skill Standards (DSS).

Human Resource Types	Committee Members
Business Architects	**Seiko Shirasaka (Lead)** **Professor, Graduate School of System Design and Management at Keio University** Masaki Ejiri Vice President, Manufacturing Division, Global Customer Success Business Group, Fujitsu Ltd. Miho Orimo Social Impact Lead in Japan, Managing Director & Partner, Boston Consulting Group Masaya Takahashi General Manager, DX Business Innovation Center, Innovation Exploring Initiative HQ, Omron Corporation Yukio Saegusa CDO/CIO, Executive Officer, Idemitsu Kosan Co., Ltd. Masanori Kurihara Head of Cards & Payments Services Division, IT Services & Payments Department, NTT DATA
Designers	**Atsushi Hasegawa (Lead)** **Professor, Institute of Innovation, Musashino Art University / President, Concent, Inc.** Manabu Ueno Executive, Sociomedia, Inc. Takayuki Fukatsu CEO, THE GUILD Co., Ltd Aya Kubosumi Senior UX Researcher, Mercari, Inc. Yumiko Tanaka KOEL Design Studio Head of Experience Design, NTT Communications Corporation Kento Izumi Director, Digital Transformation Promotion Dept, Toyota Motor Corporation
Data Scientists	**Satoshi Saeki (Lead)** **CMO, Shinsei Financial Co., Ltd. / Vice-chairperson of the Skill Definition Committee, The Japan Data Scientist Society** Daisuke Kochu Senior Data Scientist, AI Analytics Division, NEC Corporation Norimitsu Takahashi Representative Director, Digital Growth Academia, INC. / Executive Officer, CHANGE Holdings, Inc. Kazuhiro Moriya President, Data Analytics Design Atelier / CTO and Executive Officer, Data Analytics Labo Co.
Software Engineers	**Eiichi Hanyuda (Lead)** **CTO and Executive Officer, Mamezou Co., Ltd. / Professional Fellow / Professional Engineer (Information Engineering Department)** Noriaki Wada Agile Consultant, Japan Global Gateway, Fujitsu Ltd. Kohei Matsushita Technology Evangelist, SORACOM, INC. Daichi Hiroki Representative Director, rector, inc. Shusuke Fujii Senior Architect, Information Systems Group Hoshino Resorts Inc.
Cyber Security	**Hiroshi Takechi (Lead)** **Executive Expert, Cyber Security Strategy Division, NEC Corporation** **Representative, Information Security Operation Providers Group Japan** Hiroshi Arakawa Director, Cyber Risk Intelligence Center / President ENNA Co., Ltd. Toshihiro Hirayama Professor & Assistant to the Dean, Professional University of Information and Management for Innovation (iU) Tetsushi Mochida Representative, Information Security Education Providers Association (ISEPA) / Senior Consultant, LAC Co., Ltd. Yasuo Tan Vice-President / Professor, Japan Advanced Institute of Science and Technology Hiroshi Sasaki Director, OT Business Development Division, Fortinet Japan G.K.