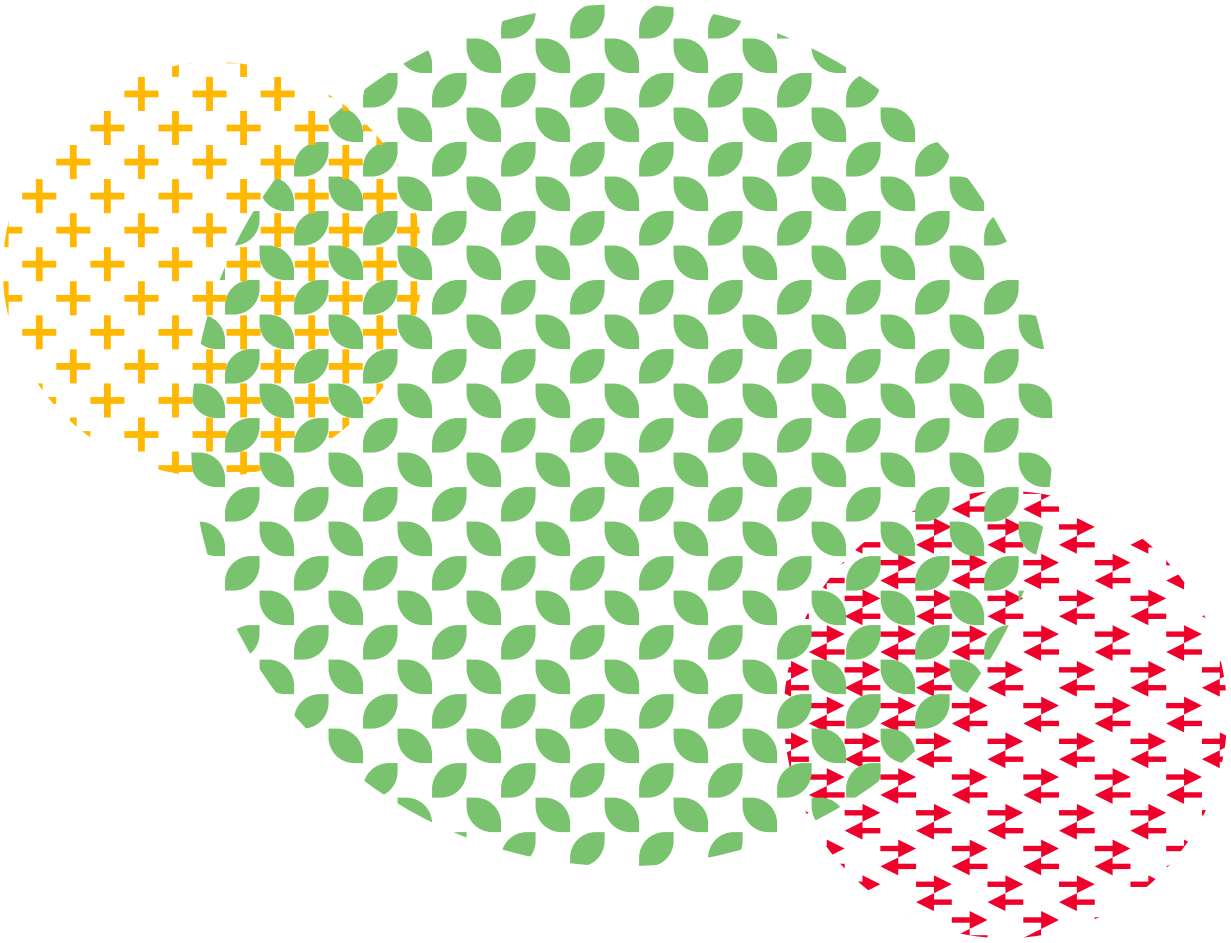
NATIONAL DIGITAL TWIN PROGRAMME

Developing a Capability Enhancement Programme

Supporting the development and adoption of the Information Management Framework (IMF) and National Digital Twin (NDT)



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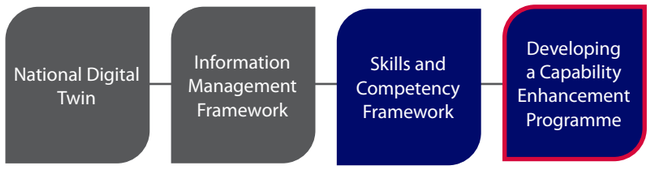
Executive summary

Developing a Capability Enhancement Programme



To successfully enhance the capabilities of the industry to support the Information Management Framework (IMF) and National Digital Twin (NDT), requires the creation of Capability Enhancement Programmes and training materials that actively drive development of the right skills (both business and digital) in the right sequence and to the right level. These programmes must identify the key steps needed to bring organisations and individuals up to the level of expertise required and equip organisations with tools, guidance and materials to understand and cultivate the skills and knowledge they need across the different roles set out in the IMF Skills and Competency Framework. This is the focus of this publication by the Centre for Digital Built Britain (CDBB) as part of the Construction Innovation Hub, supporting the National Digital Twin Programme's aim.

Intended audiences

This document is intended to support a diverse set of stakeholders across the built environment, some of which are outlined below. Specifically it targets early adopters of the IMF and digital twins, who can help support the NDT:

- asset owners and operators
- national built environment institutions
- government and policy makers
- the built environment community
- education institutions.

Key definitions

Individual capability

The extent to which someone can perform a role based on a combination of skill, competency and experience.

Organisational capability

Turning knowledge, skills, attitudes and experience into organisational level outcomes.

Career pathway

The choices individuals make when thinking about the type of role they want to have in future, e.g. generalist, specialist or hybrid.

Competency

Skill applied in a particular context through behaviours expressed in a measurable way.

Competency indicators

Each competency level is measured using a set of competency indicators, which are descriptions of the skill in practice.

Learning mindset

A framework for understanding the process of how individuals learn from experiences and approach future tasks.

Self-assessment

A self-serving questionnaire designed to assess an individual's competency level based on the priority skills needed to develop and adopt the IMF.

Skill

Specific learned ability that an individual requires to perform a given role successfully, e.g. communication.

Training plans

Developed by organisations or individuals using the training register and results from the self-assessment, alongside a view of the individual's future career pathway.

Using this document

For organisations

Approach

A step-by-step guide for organisations in how to use this document and the accompanying Skills and Competency Framework to develop a Capability Enhancement Programme targeting high priority roles and skills.

For individuals

Approach

The architecture that underpins lifelong learning explaining how individuals engage, learn, apply and reflect on their learning with extra emphasis on learning pathways, adopting a learning mindset and career path choices.

Examples

The approach put into practice by showcasing the process of developing a career path and examples of training plans that individuals can expect to uncover by following the process.

Tools

The enablers that make learning straightforward by providing self-assessments to understand learning needs and learning mindset. This provides individuals with the prerequisites they need to confidently understand and log the relevant training needed to progress.

The national view

Upskilling the Built Environment industry

The true value of digital twins and the National Digital Twin comes from their ability to inform real-time decision making and provide key insights which help organisations optimise their asset estates, model different scenarios and interventions, and collect and synthesize huge volumes of rich data from across sectors, organisations and supply chains.

Behind every digital twin is a person, someone empowered to make decisions based on timely, accurate and good quality information. To realise the full value from and help to operationalise and connect digital twins, it is fundamental that the impacts on people, roles, skills and capability are clearly understood.

To successfully enhance the capabilities of the Built Environment sector will require the creation of policies, programmes, training courses and supporting infrastructure that targets development of the right skills, in the right sequence and to the right level. It will take a concerted effort from across government, education, academic and professional institutions, industry bodies and the supply chain to make this happen.

Key national roles needed to drive change

The Skills and Competency Framework outlines the priority national roles required to drive adoption and implementation of the IMF and National Digital Twin. Roles are not mapped to individuals but are grouped by a distinctive set of tasks. It is likely that in some organisations one individual could be performing multiple roles.

- Benefits Managers
- Cyber Security Specialists
- Data Regulator
- Industry Leaders
- NDT Architect
- Ontologist
- Policy Makers
- Sector Regulator.

Not all of the above roles are filled or in place, so the first step is for relevant national organisations to understand the skill and competency requirements of these roles, and then use their position, experience and resources to support industry-wide capability development to address any gaps.

Where should support come from?

For all effort and investment made in developing capabilities at an organisational level, it is crucial that this is matched at a national level if the National Digital Twin is to become a reality. A key question to answer is 'who is responsible for this?' The answer is a diverse set of government and industry bodies, institutions and supply chain providers. Collectively, these actors will need to take ownership and responsibility for developing new policies, updating training/learning offerings and services, and investing in industry-wide capability building from education through to professional accreditations and continuing professional development.

Government, including the national curriculum

Apprenticeship and employment schemes

Education and academic institutions

Professional institutions

Industry bodies

Supply chain

Successful national initiative example

The government apprentice scheme provides a range of benefits to infrastructure owners and operators who take part. As an example, Anglian Water uses the Level 6 Digital and Technology Solutions Degree Apprenticeship which enables individuals to earn whilst they learn, combining academic study at University with substantial training and development of transferable skills in the workplace. This apprenticeship develops the technical, business, project, interpersonal and behavioural skills and knowledge to operate effectively in today's changing digital landscape.

> **"It has brought a range of benefits to Anglian, including improved innovation in teams with apprentices and general improvement in digital skills across teams where our apprentices have been able to share knowledge and learning. More schemes to build talent and new skills are crucial for the transformation of our industry."**
>
> Anglian Water, Training and Development Business Partner

Building on this - we must do more nationally

As outlined above, building capabilities across the Built Environment industry will require concerted national effort across a diverse set of actors. Given the complexity of this and the need for extensive engagement, research and participation at a national level, the remainder of this document focuses instead on how organisations can build capability based on what is currently available today. It is recognised that this is only part of the equation, and through highlighting this a gap we hope that relevant organisations can use this document and the accompanying Skills and Competency Framework to begin targeting capability development at a national scale.

The key outcome needed is a national Capability Enhancement Programme that helps develop foundational data, digital and business skills, while providing in-depth training and resources to create more experts who understand and can contribute to the development of the Information Management Framework, and more consultants who can talk knowledgeably about the IMF and help organisations implement it to enable the National Digital Twin. We need to increase security mindedness capability if we are to have secure, resilient data gathering, processing, sharing and storage and further work will need to be done to identify the specific skills for this.

Organisation approach

Defining organisational capability

Organisational capabilities describe a specific function or set of functions that an organisation can perform successfully, for example, innovation, strategy development and asset management. They are what you get when you have appropriately skilled people performing defined roles to achieve a strategic vision or direction, supported by appropriate process, organisational structures and culture (Figure 1).

Another way of looking at it is:

Organisational capability is what turns knowledge, skills, attitudes and experience into outcomes.

The capabilities required to adopt and implement the Information Management Framework (IMF) and the National Digital Twin (NDT) will emerge from different functions and groups across an organisation, not one single area. It is this development and enhancement of organisational capability that requires targeted and proactive focus, supported by top down direction and buy-in.

This section of the document focuses on what can be done at an organisational level to enhance capability, outlining some of the data and information related challenges this can help to overcome, including:

- **Data valuation** - it can be hard to attribute a pound sign to data.
- **Data and information security** - security issues around aggregating and sharing data, limiting its value.
- **Resistance to data sharing** - protectionist attitudes and behaviours.
- **Data and digital literacy gaps** - weaknesses in some areas in terms of basic data and digital skills.
- **Assurance and ethics** - concerns around potential misuse of data, reliance on machines to inform decision making and the quality of data on which decisions are made.

Not only will overcoming these challenges support the IMF and NDT, for organisations it can mean: enhanced decision making, trust and security, breaking down barriers to data sharing and supporting strategic objectives such as meeting net zero targets.

Roles, skills and people; a key part of the jigsaw

There are multiple elements to enhancing organisational capability, shown in Figure 1. This document focuses on **roles**, **skills** and **people**, but for long-term capability enhancement, all elements need to be in place. Without these, it will be difficult for organisations to sustain the change over time and any short-term enthusiasm for enhancing capability could fade or dissipate.

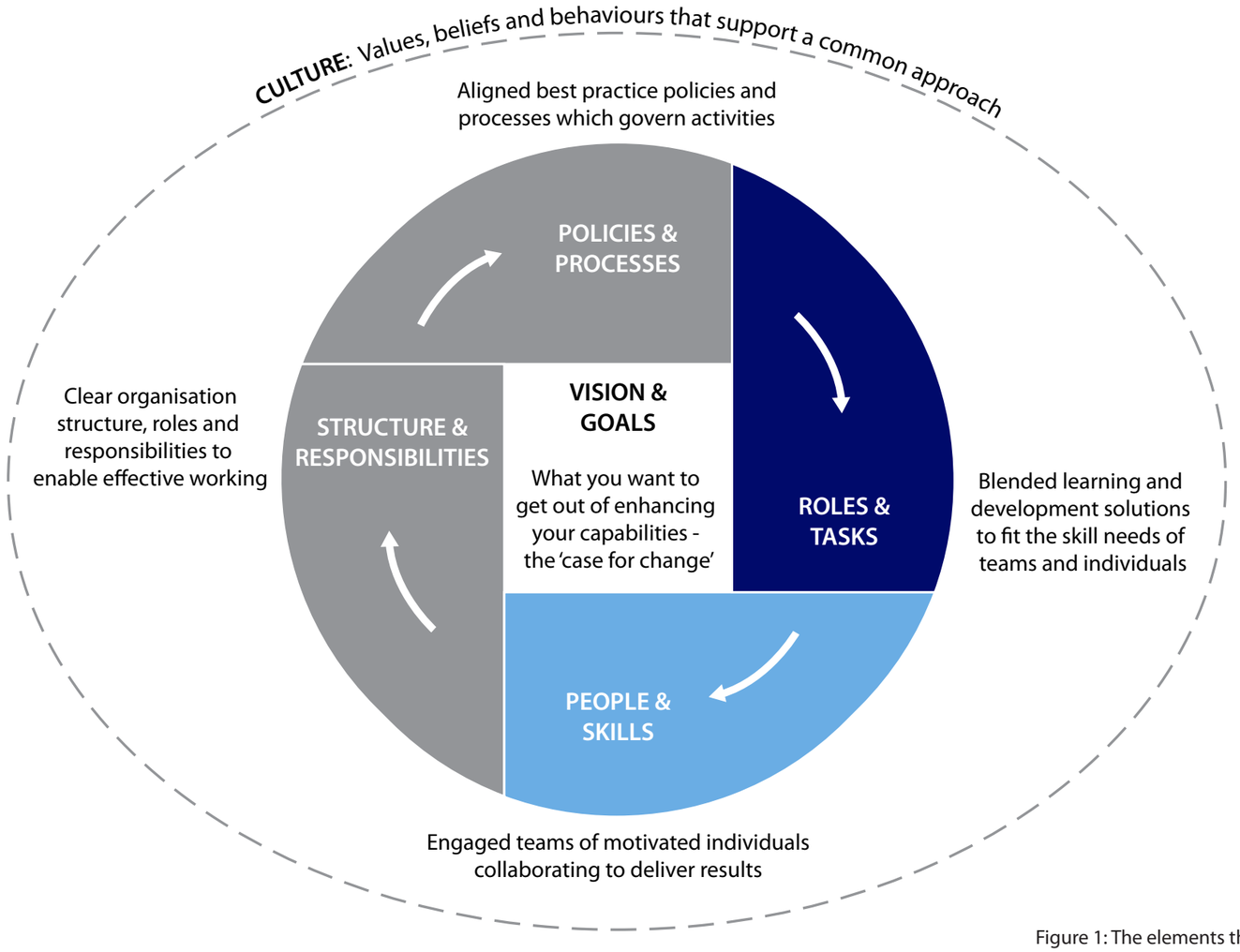


Figure 1: The elements that make up organisational capabilities

Building organisational capability

As an organisation, what can you do to enhance your organisation capabilities to implement the IMF and NDT?

The steps, outlined below and covered in more detail in the following pages, set out the recommended approach for enhancing digital and business skills to inform better information management (this supports the IMF). It is advised that these steps are followed in order to create your own organisational Capability Enhancement Programme. At the end of each step there is a clear decision point so you can assess whether you are ready to progress to the next step. This continuous process of evaluation will help to maintain alignment among key stakeholders and ensures best practice is followed through each step.

Feedback loop: Once you have followed the five steps and successfully delivered your Capability Enhancement Programme, it is advised to go back and complete step three, four and five again for continuous capability improvement.

1. Align to strategy

Are digital twins part of your strategy?

Do you have the strategic drive and buy-in to implement and adopt the IMF and enhance digital and data capabilities?

2. Assess change readiness

Are you ready to change?

Are the prerequisites in place to enhance capability as part of an organisation change programme?

3. Identify roles and skills needed

Where are you starting from?

What previous work have you done on developing digital twins and improving information management practices.

4. Understand capability gaps

Where do you have specific capability gaps in your people and skills?

What roles and skills do you have in place, are they at the right level in terms of competency and are there any gaps that need to be addressed?

5. Develop Capability Enhancement Programme

1. Providing training
2. Recruitment

What does your Capability Enhancement Programme need to focus on?

What actions can you take to address gaps in capability and how do you prioritise and sequence these?

1

Align to strategy

Having the strategic drive and buy-in to implement and adopt the IMF and enhance digital and business skills to inform better data management (this supports the IMF).

KEY QUESTIONS TO ASK YOURSELF

1. Are digital twins and improving information management and quality part of our strategy?
2. Would we benefit from sharing our data with other organisations with more speed and consistency?
3. Would strengthening capability in this area help us to meet our strategic objectives and targets?

KEY DECISION

Is improving data quality, management and connecting data from different sources and organisations a priority for us right now?

No — This framework may be helpful if the situation changes but for now consider joining the DT Hub to stay engaged on the developments in this space.

Yes — Continue to step 2.

WHO NEEDS TO BE INVOLVED

- Leadership including Chief Digital Officer, Chief Information Officer and Chief Financial Officer
- Digital
- IT
- Asset management
- Operation leadership

The strategic imperative for better information management

While developing a digital twin might not be the right thing for every organisation, improving organisational capabilities in the areas of information management can help to unlock a range of business benefits.

Better information management can help your organisation to:

- understand the value of data and the potential it has to support better decision making
- make better decisions
- improve the clarity around ownership and accountability for data
- make it easier to share data across different teams, functions and organisational boundaries
- better understand your assets and take proactive actions to manage them
- reduce operational and commercial risks
- get value from innovation through better insights into emerging opportunities.

If some or any of these aspirations feature in your enterprise or digital strategy, then this Capability Enhancement Programme approach will be relevant for you. At its core, it is about identifying gaps in roles and skills across your organisation and working to fill those gaps through training/upskilling, recruitment and partnering.

Thinking beyond the Information Management Framework

The Information Management Framework (IMF) is a prominent feature throughout this document, given its role in supporting the National Digital Twin. However, in the course of developing this guidance, many organisations have said they see the value in building information management capabilities irrespective of the IMF, even if the idea of a digital twin is still a future aspiration. For smaller organisations with less resources available to invest in capability building, many of the steps and recommended actions will still be relevant and can be efficiently managed at a smaller scale.

Aligning to existing strategies to secure buy-in and investment

Taking the time to decide whether improved information management through a Capability Enhancement Programme is right for your organisation, and aligning it to your enterprise or digital strategy, can help generate buy-in among senior stakeholders. It can also help to secure funding or investment if it can be clearly linked to strategic business goals, but will likely be considered against other ongoing digital and transformation initiatives. Organisations should not underestimate the importance that people will play in enabling digital transformation, so this should be taken into account when determining priorities for intervention.

2

Assess change readiness

Are the prerequisites in place to enhance capability as part of an organisational change programme?

KEY QUESTIONS TO ASK YOURSELF

1. What other internal change initiatives are in place and is this complementary or competing?
2. Does adopting connected digital twins align with our organisation's purpose and mission?
3. Does this organisation have a successful track record of implementing change of this type at this scale?
4. Do we have the right people and knowledge to do this and communicate it well?

KEY DECISION

Are the prerequisites in place to enhance capability as part of an organisation change programme?

No — Assign Capability Enhancement Programme owner [Change Sponsor] and assign date on transformation roadmap to start change.

Yes — Continue to step 3.

WHO NEEDS TO BE INVOLVED

- Leadership including Chief Digital Officer and Chief Information Officer
- HR
- Learning and development and internal communications teams
- Change sponsor
- IT

Assessing organisational readiness for change

When you've made the decision to develop a Capability Enhancement Programme, the next step is to make sure it is a success. To increase the likelihood of a successful Capability Enhancement Programme, it is important to spend time understanding how ready your organisation is to undertake the change. Part of the focus should be on overcoming barriers that may negatively impact your enhancement programme. All the training and other initiatives which will form your Capability Enhancement Programme impact business as usual. Therefore, considerable work needs to be done to assess whether these elements of the business are ready for the change.

Various elements to assess for readiness:

- **Values and culture** - core values of an organisation that are evidenced in work ethic and operations.
- **Structure and governance** - in terms of who reports to whom and how teams are assigned.
- **Systems** - the technology, activities and processes that staff members engage with to do their day-to-day job.
- **Leadership** - what is the style of leadership.

Points to consider:

1. Could our culture be a barrier implementing this change? And how do we mitigate this?
2. Is the organisation prepared to fully implement new structures, processes and policies to support better management of information? Will the new skills and behaviours required be rewarded and recognised?
3. Do we have the roles and skills which will contribute to the new capability of the organisation?
4. What feedback mechanisms do we already have in place to measure the success of the change?

Change impact assessment method

A change impact assessment should be conducted to get a high-level view of the impact capability building will have on your organisation. As a follow on, a stakeholder impact assessment should be used to analyse the impacts in each department or area of your organisation in more detail.

Signs of organisational readiness

A critical focus of change readiness is to thoroughly understand the culture of your organisation and how engaged people are. You can prepare the organisation for new capability by communicating to all affected employees what is happening, when it will happen and when the benefits to them are. This will contribute to organisation wide buy-in, willingness and capacity to change.

Figure 2: Key outcomes of organisational readiness

3 Identify roles and skills needed

What is your starting point? Understanding what capability you have today and what stage of your digital twin development journey you are in.

KEY QUESTIONS TO ASK YOURSELF

1. What stage of our digital twin development journey are we in?
2. Have we baselined our organisational roles against the priority roles listed in the Skills and Competency Framework?
3. Are there individuals or groups of individuals already performing some of these roles?

KEY DECISION

Are there gaps in roles?

No — Revisit this stage in six to twelve months' time.

Yes — Continue to step 4.

WHO NEEDS TO BE INVOLVED

- Function/department leadership
- HR
- Digital team

! Please note: roles do not always map one-to-one with an individual. Individuals performing a role may take on other roles within their organisation, or parts of the role may be performed by multiple people.

Please note this is not an exhaustive list - it highlights what is most important in relation to the IMF and NDT.

Example role matrix developed with a pilot participant

Instructions:

For the purpose of this document, we identify the five key stages of a digital twin journey to enable you to understand what roles you need now and in the future.

Organisations could, for example, be developing a digital twin of an individual component or a complete digital twin of a rail system. This highlights that the complexity of digital twin development should coincide with the number of roles needed. This example of a roles matrix, developed with pilot participants, demonstrates that it is not necessarily that you need a large number of individuals, but the underlying skills within these roles are important to the success of any digital twin, regardless of size or complexity.

Use the **roles matrix** to identify the roles you need to make your digital twin a success. The matrix on the right is a example developed with pilot participants. The darker the shade of blue, the more important these roles are to your digital twin development stage. This is regardless of complexity and based on best practice. Information management maturity is key to quality information and a successful digital twin so the majority of roles focus in this area.

This matrix can be used to establish what roles you currently have and which ones are potentially missing and could be affecting your chance of success at each stage of digital twin development.

Once you have established your existing maturity you're able to move onto the next stage - identifying capability gaps.

Digital Twin (DT) development stage

KEY: Level of importance

	Strategy Business case with benefits, leading to organisational direction and accountability	Pilot Proof of concept with measurable outcomes, benefits and learnings for the DT technical foundations	Scale Increase the size and quality of the pilot - continued focus on process modelling and information management	Operate Continuous improvement to the process lifecycle to ensure quality information	Integrate Share information to the NDT by relating organisational information management to the national IMF
Cyber Security Specialist					
Data Architect					
Data Consumer					
Data Custodian					
Data Producer					
Data Steward					
Data Leader					
Process Modeller					
Business Analyst					
Benefits Manager					
Change Manager					
Data Governance Specialist					
Data Quality Analyst					
Enterprise Architect					
Product Manager					
Process Owner					
User Researcher					

Figure 3: Roles matrix

4

Understanding capability gaps

What roles and skills do you have in place, are they at the right level in terms of competency and are there any gaps that need to be addressed in order to get there?

KEY QUESTIONS TO ASK YOURSELF

1. Where people are in roles, do they have any gaps in skills or competency?
2. Do we have any existing information on competencies?
3. Through structured interviews, based on the competencies in the Skills and Competency Framework is there other evidence we can use to understand the gap, e.g. evidence of already demonstrating aspects of the new role?

KEY DECISION

Are there gaps in skills?

No – Monitor and review in six months' time.

Yes – Develop a targeted Capability Enhancement Programme, which may include training, partnering or recruitment – go to step 5.

WHO NEEDS TO BE INVOLVED

- Leadership including Chief Information Officer and Chief Digital Officer
- HR
- Digital team

Identifying gaps

Once you have used the roles matrix in stage three to assess where you are in your digital twin development journey, it's possible to understand your capability gaps. To identify gaps in your capability, thoughtful and comprehensive planning is needed. Strategic workforce planning guarantees an alignment to your organisation's business strategy which is key for building capability in connecting digital twins and integrating systems. By assessing and analysing external environment developments impacting your organisation, as well as internal business drivers and goals, you can identify the key skill areas needed to meet future needs.

Proactive rather than reactive

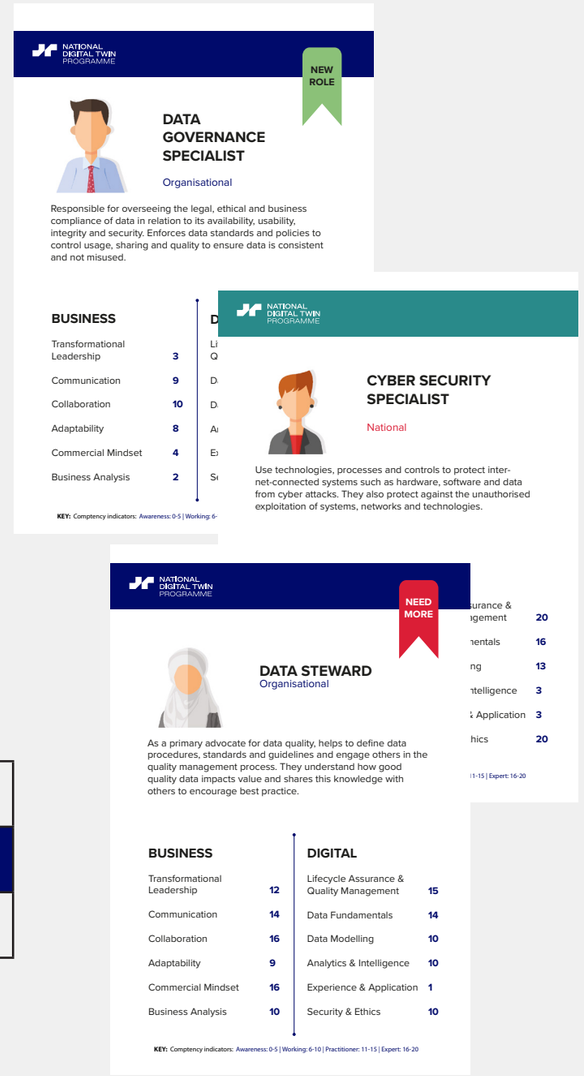
It starts with developing an overall workforce plan which involves *"...the process of balancing labour supply (skills) against the demand (numbers needed). It includes analysing the current workforce, determining future workforce needs, identifying the gap between the present and the future, and implementing solutions so that an organisation can accomplish its mission, goals, and strategic plan" (CIPD, 2020).*

The Skills and Competency Framework includes the list of roles and skills needed across an organisation to implement and adopt the IMF, enabling the National Digital Twin. This can be used to assess where you want to be and the workforce composition you need depending on where you are in digital twin development. For example, as you start out on your journey towards the National Digital Twin you will need a different mix of roles and skills at each stage.

	Strategy	Pilot	Scale	Operate	Integrate
Cyber Security Specialist		■	■	■	■
Data Producer				■	

Using the Cyber Security Specialist and Data Producer roles as an example, you can see Cyber Security is a must throughout Pilot, Scale, Operate and Integrate, whereas Data Producer is must have only in the Operate stage. Without understanding where roles are needed in the stages, staff lacking the right mix of business and digital skills could be placed in a challenging position where they do not have the required level of competency to fulfil the requirements of the role, leading to performance issues, creating stress for the individual and inhibiting efforts to develop and implement the IMF and digital twins.

Once you have identified gaps and examined the areas you'd like to focus on, you can move on to **how** you can build capability.



5 Develop Capability Enhancement Programme

What actions can you take to address gaps in capability and how do you prioritise and sequence these?

KEY QUESTIONS TO ASK YOURSELF

1. Do we have the resources in our organisation to deliver capability building, i.e. HR team, training department and leadership who are engaged and wanting to make a difference.
2. Have we shared the target capability objectives across our organisation to get buy in?
3. How will we measure the success of skills development and training?

KEY DECISION

Have we appropriately scoped, planned and funded your Capability Enhancement Programme?

No — Use this document to address any outstanding areas.

Yes — Proceed with Capability Enhancement Programme.

WHO NEEDS TO BE INVOLVED

- Leadership
- Capability Enhancement Programme team
- Internal communications team
- End users (the individuals whose capabilities are being developed)

Designing a Capability Enhancement Programme (CEP) specific to your organisation

Building organisational capability can be challenging. It is important to approach it in the right way. This means viewing it as a programme of change that will require a good understanding of organisational gaps, and a clear vision, goals and objectives for what you want to achieve.

Human Resources (HR) will play a key part in driving and supporting many aspects of work in building capability and should therefore be heavily involved at this stage.

Your Capability Enhancement Programme will need to include the following elements:

1. Objectives and scope of the programme

The capability gaps you identified in the previous stage (4) can be used to design the objectives of your programme. You should also ensure the objectives of your CEP align to the strategic business objectives in your organisation, to ensure any investment in a CEP is valuable and will bring benefit.

Example CEP objective: Develop organisational capability in information management to support the business in acquiring, using and delivering information to those who need it.

2. Describe the target capability from the start

This will ensure that you can go back to this throughout the programme to ensure the focus remains on track and the methods for building capability are aligned to business needs. This will require leadership sponsorship, as success often relies on the level of senior sponsorships in place. Example framing questions to create the definition of the target capability include: 'what will the capability deliver?' and 'which are the key delivery competencies?'

3. Methods used to enhance capability (skills, roles and people focus)

Address gaps either by using training plans to upskill staff or recruiting new people into the organisation with the right skills and competencies.

- **Employee training and development**: refers to a wide range of educational and learning-based tools. A guide for developing role-based training is provided in the 'For individuals' section of this document.
- **Recruitment**: using understanding of capability gaps to hire individuals with the right mix of skills and experience.
- **Partnering**: drawing on the expertise of partners and suppliers to fill gaps in capability, either on a short-term or long-term basis.

4. Key outcomes and programme management activities

As well as key business outcomes associated with improved information management, organisations can expect to see:

- improved digital confidence among staff
- enhanced professional development and learning experiences
- increased employee satisfaction
- greater awareness for information-related career pathways within the Built Environment.

An example of a desired outcome of a Capability Enhancement Programme for an infrastructure operator might be that staff are able to understand how improved information management processes can prevent recurrences in maintenance issues.

5 Providing training

Role-based training

A selection of existing training courses available at the time of developing the document have been provided in a Training Register, which accompanies this guidance. Assessing quality of training providers is important and the following criteria have been used to compile the Training Register.

Quality Assessment Criteria (QAC):

Is accredited or widely respected in the field.	Recommended by industry training body.	Has courses that are kept current and up to date.	Has an expert team or partners with industry experts for tailored content development.	Provides metrics for self assessment to ensure learning has been achieved.	Provides clearly articulated programme goals and learner outcomes

We provide guidance later in this document on the best practice principles that support effective adult learning, which can also be used to evaluate the effectiveness of training methodologies.

Organisation decisions on training

- **Purchase off-the-shelf** - examples provided in the Training Register accompanying this document. It is recommended that as an organisation you use this long list and recommend your top three to five for each role, so that it's more digestible for individuals.
- **Create from scratch in-house** - recommended for those organisations with experts already in place within their organisation, who are able to provide real-life examples and demonstrate best practice.
- **Identify a trainer to customise training for individuals** - for those organisations who would like to partner with a professional training organisation, who can deliver and play some role in tweaking material and tailor material for an organisation's needs. An output of this might be a training programme of blended learning courses designed to address key capability challenges experienced by that organisation.

Using external training providers: purchasing 'off-the-shelf' products vs needing 'true' partnership

The decision to partner with an external provider to either co-create or outsource the development of training content is most likely to be a combination of two key factors:

- perceived specialism of the content required
- internal 'constraints' (lack of resource to service the sophistication/scale of the demand).

Dependent on the scale and complexity of the training being commissioned, there will be a choice to determine whether this relationship is more transactional (buying a commoditised training product requiring little to no bespoking) or whether a deeper partnership is required.

Where a partnership approach is pursued, depending on the scale of the demand, it will be important to determine whether a competitive tendering process is required or not. If not the case, then a decision can be taken to use the Training Register to select the most appropriate content and then initiate partner contact. If a tendering process is required, this will trigger a need to use your organisation's preferred procurement processes.

In both cases, ensuring the best fit selection of a prospective partner is likely to be based on demonstrating credibility across the quality assessment criteria shown previously. A likely other factor will be price/budget. You should consider programme costs regardless of whether the QAC has been met.

Dependent on the scale and complexity of the training being commissioned, it will be important to ensure that the appropriate set-up phase and maintenance 'rhythms and routines' are created. These will include:

- A kick-off meeting with all key organisational and partner stakeholders to agree joint critical success factors and ways of working.
- Contracting around roles and responsibilities, (e.g. project plan/decision making and escalation processes).
- Agree appropriate meeting cadence and focus (weekly/monthly/quarterly).
- Determine feedback loops and ensure shared agreement around core service level agreement (SLA) measures.

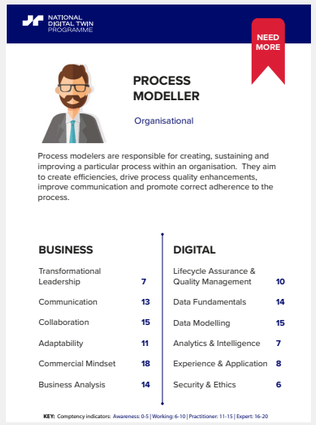
5 Recruitment

When to recruit?

Recruitment for internal positions should be undertaken when a significant skills gap is identified using the Skills and Competency Framework. The Framework was designed to equip organisations to identify employees that match particular role profiles and are collectively suited to effectively implement the Information Management Framework - in some cases one person will perform multiple roles and in other cases multiple people will share role responsibilities. Any gaps identified in your organisation, if not filled, can have significant consequences for implementation of the IMF and digital twin development.

How to recruit?

1. **Identify capability gaps** - identify the role profiles that need filling to meet the criteria in the Skills and Capability Framework (carried out in step 4).
2. **Job analysis** - before you can advertise for the role(s), you will need to define the role. To do this, you will need to create a person specification that aligns with the role profile you would like to recruit for. This is often based around knowledge, skills, attitude and experience. Speak to your HR Business Partner about how to pull this together. If hiring one individual to perform one role is not suitable for the size or complexity of your organisation, you may consider advertising for someone that can perform multiple roles (ideally with a similar skill set) e.g. Process Modeller and Process Owner.
3. **Shortlisting** - screen your pool of applicants based on the criteria identified for each role and any relevant qualifications that are essential to the role. Applications that do not match this criteria should be sifted out at this stage.
4. **Assessment** - candidates should be assessed using structured competency-based interviews, assessing them against the skills identified in their role profile at the correct level (awareness, working, practitioner, expert). Everyone involved in assessing candidates should have the necessary skills (for example in interviewing and testing) and have been adequately briefed about the job in question and its requirements.
5. **Other methods of assessment** - you may choose to use additional methods of assessment to increase the validity of your hiring decisions. These may include psychometrics, aptitude tests, assessment centres or role-related exercises. It is important at this stage that only role-specific criteria are used to screen candidates. The table on the right shows the extent to which research has shown each of these assessment methods to predict performance. The more rigorous the process, the more reliable the decision making. The cost of making the wrong assessment decision can be significant, this includes lost productivity, wasted training costs and recruitment and hiring fees.



Example: Process Modeller

Using Process Modeller as an example, once you have identified this gap in your organisation that cannot be filled by an existing employee you can look at external recruitment.

- Ensure you recruit for skills aligned to the level applicable to the role (e.g. transformational leadership - working; data engineering - expert) as well as cultural fit with the organisation.
- Examples of qualifications needed for the role may include ISO 9001 (quality management systems), relevant experience includes 3-5 years in a relevant role - candidates should be shortlisted based on this.
- A competency-based interview should be used to assess candidates against knowledge, attitude and skill requirements.
- Other assessment methods could include logical reasoning tests or a role-related exercise.

The table below shows the different methods of assessment you can use to recruit for your role alongside the extent to which they have been shown by research to predict future job performance (predictive validity), with 1.0 being a 100% predictor of performance.

Method of assessment	Predictive validity
Cognitive ability test + structured interview	0.63
Work sample test	0.54
Cognitive ability test	0.51
Structured interview	0.51
Unstructured interview	0.31
Reference check	0.26
Job experience (years)	0.18
Years of education	0.10

Figure 4: Schmidt, F. L., and Hunter, J. E. (1998). The validity and utility of selection methods in personnel psychology: Practical and theoretical implications of 85 years of research findings. Psychological bulletin, 124(2), 262.

Individual approach

Defining individual capability

Individual capability can be defined as the extent to which someone can perform a role based on a combination of skill, competency and experience.

This section is for individuals looking to understand where they might want to grow skills, acquire new skills or understand other roles and the steps they need to go through to get there. The roles and skills highlighted are the priority roles for the implementation of the IMF, enabling the National Digital Twin. Specifically, the skills are concentrated on improving data quality, data interoperability and improving information management. If you are interested in developing digital twins or connecting to the National Digital Twin, this guide will be applicable for you.

Focusing on learning and development

The approach taken to help you develop an individual training plan is designed to help you navigate what can be a complex landscape, finding the types of learning and materials that are right for you.

We have divided it into three stages: **Engage**, **Learn** and **Apply**. The division into three stages is based on the science of adult learning/ best practice for behaviour change.

Example training plans have been designed from sources recommended within the digital twin community but also through institutions and accredited bodies with a proven track record of providing quality assured development across both digital and business skills.

We recommend taking the time to develop your own personalised training plan to suit your role, and engaging with your line manager to ensure it aligns with your wider career aspirations.

The key elements of individual learning: what can you do to enhance your skills and competency?

The approach below, based on latest learning research principles, aims to help you to grow and acquire business and digital skills in the areas of information management. It is an evolution of the well known 70:20:10 approach. It acknowledges the same mix of elements required to enable learning/skill development (formal training combined with learning from others and work experiences) but highlights a more fluid interdependency between these. Core to the steps below is the importance of learning agility or 'learning to learn'.

ENGAGE

Commit

Success is influenced by the beliefs and goals you bring to the situation. For a shift to take place, you must commit to making a change. Know why you need and want to learn something before undertaking to learn it.

Measure up

Effective learners understand their strengths and development opportunities. Taking the time to assess where you are today (both your learning mindset and your current level of skill) will help you identify which skills you need to focus on, the level of competency you need to achieve and the attitudes and specific learning skills you need to enable this shift.

LEARN

Explore

Exploring a variety of different learning choices will allow you to explore a topic and find the content and style that works best for you, whether that means an intensive facilitated course or modular self-learning on the go.

Train

Applying learning in practice and reflecting on that experience is key to embedding knowledge. This will help you discover and experiment with learning first-hand, and gain feedback on it. Look for opportunities for facilitated training as this will allow you to learn from practitioners and get individual learning recommendations.

APPLY

Check up

Take the time to regularly collect feedback on how you are performing and use this to re-assess the skills and competencies you need to focus on.

Embed

Purposeful practice is needed to enhance performance so that skills and behaviours become automatic. Make sure you engage with your line manager and other colleagues so that they understand and support the learning you want to undertake to achieve your career aspirations.

Reflect | Discover

Reflection is a key part of learning. It is recommended anyone wanting to build the skills and competencies to work in this field explore and access further materials (e.g. podcasts, articles, TED talks) beyond those identified in the accompanying training register, to find learning content and methods that work best for you.

Individual approach

Engage, learn, apply steps

Illustrated here are the specific steps within the Engage, Learn, Apply approach that will help you create your personalised training plan. Following these steps will enable you to assess your current skill level in relation to your chosen role. It is also linked to different career pathways and tools suited to your needs and motivations. Undertaking steps 1-4 should take 30-45 mins.

Definitions

Career pathway - the choice you make when becoming a practitioner to either be a Hybrid, Generalist or Specialist.

- **Generalist** - the type of career path someone chooses when they have or wish to acquire a diverse set of skills (breadth). Tends to be more suited to a management role and needs more in-depth business skills.
- **Hybrid** - the type of career path someone chooses when they are suited to both a specialist and generalist role. They will need a clear mix of business and digital skills covering both breadth and depth.
- **Specialist** - the type of career path someone chooses when they want to be seen as a leading expert on a particular subject (depth). Tends to suit a more technical role and needs more in-depth digital skills.

Learning mindset - a framework for understanding the process of how individuals learn from experiences and approach future tasks.

Self-assessment - a self-rating questionnaire designed to assess your current competency level based on the priority skills needed to develop and adopt the IMF.

Training plans - developed by individuals using the training register and results from the self-assessment.

Steps	**Step 1:** Identify role	**Step 2:** Assess skill level and learning mindset	**Step 3:** Choose career pathway	**Step 4:** Finalise training plan	**Step 5:** Undertake training	**Step 6:** Re-assess capability	**Step 7** Embed learning
Objectives	Choose the role most suited to your current skillset and/or future career aspirations.	Assess your learning mindset and your current skill level against the skills needed for your role profile.	Select your career pathway based on your future career aspirations.	Identify the training needed in order to fill the skill gaps necessary for your role.	Undertake training set out in the plan, engaging with your line manager to ensure organisational support.	Regularly re-assess your current skill level to ensure you are fulfilling the skill requirements of your role.	Take the time to apply your learning in everyday situations. Strive for continuous improvement to embed your learning.
Activities	• Review Competency Scorecards in the Skills and Competency Framework to see which role identifies you best. • If you'd like more detail on your chosen Competency Scorecard, you can read the Role Profile.	• Fill in the self-assessment questionnaire. • Identify your key development areas. • Review which aspects of your learning mindset need to be improved to get the most from your learning.	• Select your desired career pathway by reviewing page 31. • If you select the 'Specialist' pathway, you may choose to put extra focus on digital skills. • If you select the 'Generalist' pathway, you may choose to put extra focus on business skills.	• Organise your training plan in a way that works for you. • Ensure you are focusing on the right skills at the right level for your role (awareness, working, practitioner, expert).	• Undertake the training necessary to fill your skill gaps. • Ensure you start with training you identified as development areas in your self-assessment.	• Take the self-assessment every 6 months to ensure your skill levels are up-to-date. • Make sure to have conversations with both your peers and your line manager to ensure an accurate self-assessment.	• Implement what you have learnt in your training through deliberate practice and social learning. • Consider keeping a learning log to help keep track of and embed your learning.

Individual approach

Learning mindset

The learning mindset is a framework for understanding the process of how individuals learn from experiences and approach future tasks.

Recent research has found that the quality of an individual's learning strategies is a better predictor of future success than their knowledge, current technique or years of experience.

Given the accelerating pace of digital change within the infrastructure sector, current roles and skills required are forming and shifting and will continue to do so.

As highlighted, having a mindset that values the importance of effort and learning over ability will act as a performance differentiator for you in this context. This is extremely important when looking to develop information management capability and improve data quality because information is used in almost every situation. Individuals need to apply their learning to how they interact with information on a constant basis.

Using learning mindset in the Capability Enhancement Programme:

As illustrated previously, your learning mindset will be measured as a part of the 'measure up' section of the role-based training plan. When beginning these training plans, it will allow you to be more self aware about how your own attitudes and 'learning skills' can be helping/hindering your ability to learn most effectively. By using this awareness, you will be able to take more personal responsibility for ensuring you maximise the learning experiences within your training plan and apply these in practice.

What do you need to adopt a learning mindset?

The descriptions below outline each component of the learning mindset framework, followed by actions you can take to improve on each component:

Self-perception - to learn effectively, we need to have an accurate understanding of our strengths and weaknesses, and genuinely believe in our ability to succeed at work.

- Taking the measure-up questionnaire is the first step to identifying your strengths and development areas. Ensure you continue to reflect on your own abilities and the impact you are having on others around you.

Embracing challenge - errors and challenge are embraced as valuable tools for success. Putting ourselves in challenging positions creates stretching opportunities, so we learn. Strategies to better enable you to embrace challenge include:

- Reminding yourself that your abilities are not fixed and can be developed through dedication and hard work
- Re-appraising challenge and using it as an opportunity to develop skills
- Using perceived failure as an opportunity for growth and development.

Conscious reflection - effective learners are able to effectively weigh up any feedback they receive, draw learning from both their successes and their failures, and identify the changes needed to enhance their performance. Strategies to better enable you to consciously reflect include:

- Regularly reviewing how you are completing tasks (both strengths and opportunities to improve) to keep iterating the way you approach them
- Reflecting on how your performance may be perceived by / be impacting others
- Learning from setbacks and adjusting your approach as quickly as possible ('fast failure').

Commit to practice - with practice, skills become automated and require less mental capacity. We are able to retrieve knowledge effortlessly, with less demand on conscious attention. The more you work, the more your ability grows and this creates a receptiveness to challenging situations. Strategies to better enable you to practise your learning include:

- Planning your development goals and regularly assess your progress against them
- Deliberately practising and actively seeking feedback on work tasks and skills to improve your performance
- Identifying strategies to help you achieve your development goals.

Drive to learn and transfer - we also need to feel driven to improve our performance at work and to transfer this learning into practice. The information that we acquire needs to be transferred into new learned behaviours and practised.

- Plan your development goals and regularly assess your progress against them.
- Deliberately practise work task and skills to improve your performance.
- Seek to maximise all available support to help you achieve your development goals.

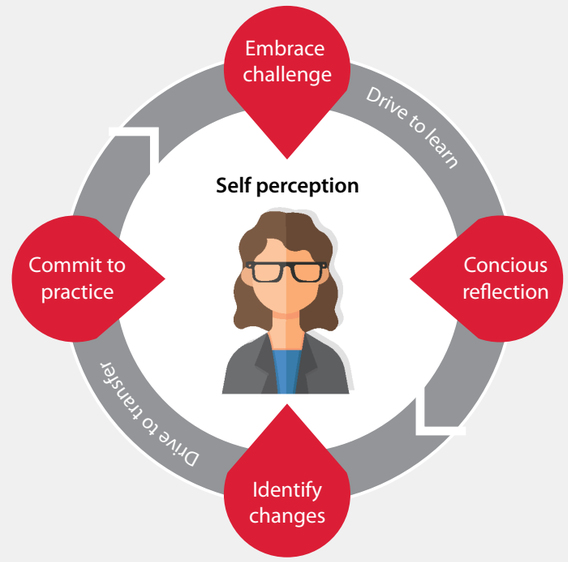


Figure 5: Learning mindset

Individual approach

"I like the career pathway, I find it a nice and simple way to look at Data and Information roles. I can see myself in this and found it fits very well of my impression of how this industry works.'"

Network Rail Data Steward

Career pathways

The career pathway demonstrates you have a choice between choosing to be a Specialist, Generalist or Hybrid. Specialists, Generalists and Hybrids all have particular strengths with Specialists being able to provide expert and industry-leading knowledge in specific skill areas and Generalists having a more balanced mix of skills and competencies. Hybrids play an important role in bridging the gap between the technical and non-technical roles and activities. Hybrids are especially useful at empathising with both Specialists and Generalists and often have greater skills in translating technical jargon into relatable business terms.

Recommendation

Choosing your career path should be made when becoming a practitioner, so that individuals have a baseline of knowledge that they can take into a direction that suits them best.

Measure up

Self-assessments are very important for each stage in a learner's learning pathway to assess the current state and where they want to go next. As learners move through competency levels it is important to always re-evaluate learning to see what has worked and what hasn't, and where social learning and other forms of training (i.e. classroom or mentorship) could help.

Embed

Throughout learning it is important that training is not done in isolation but is discussed with colleagues, line managers and put into 'on-the-job' practice. This is represented by the dotted white line indicating the continuous learning journey outside of any training.

Plotting your career pathway

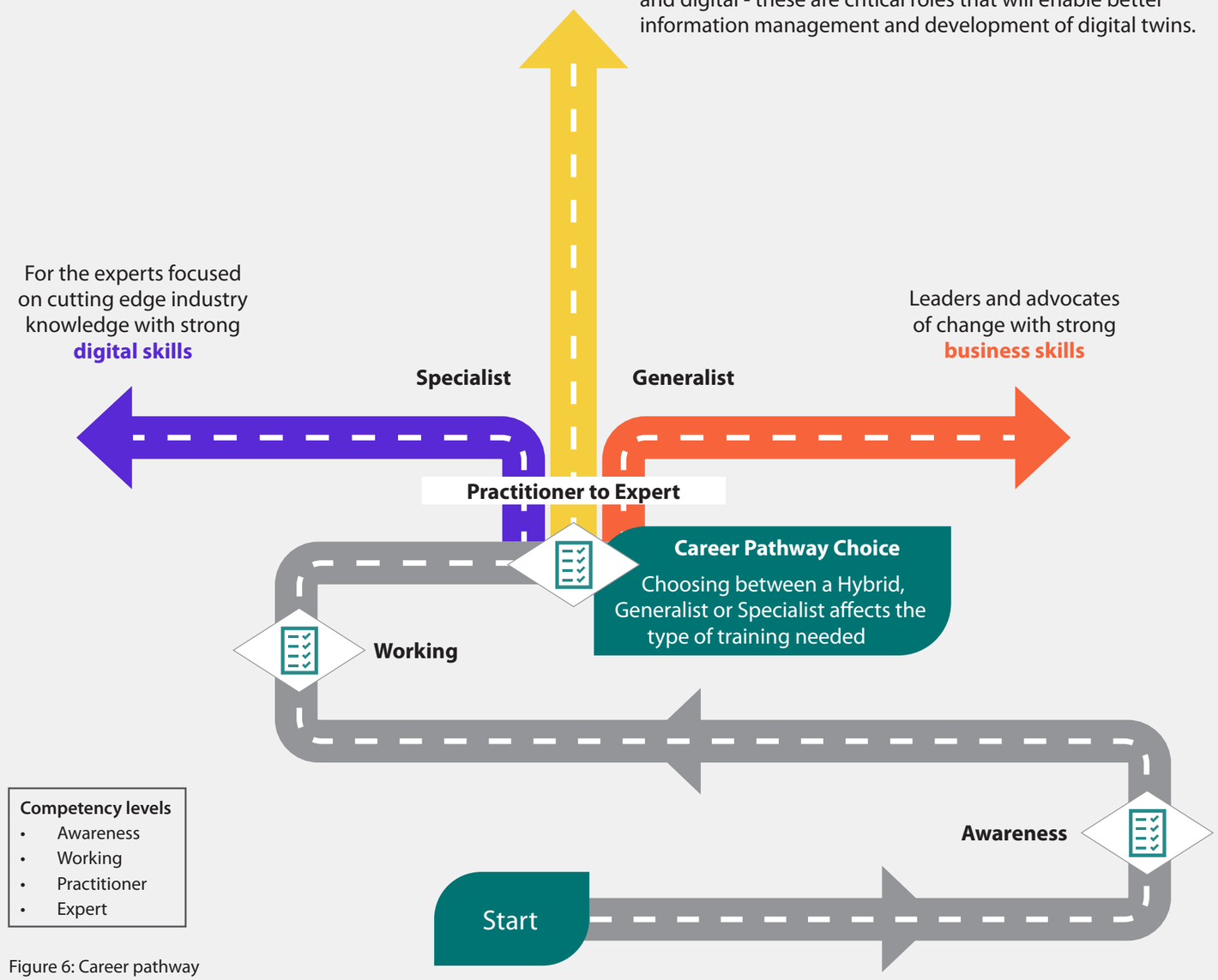


Figure 6: Career pathway

Examples - organisational roles

Data Steward training plan

Prerequisites to developing a training plan:

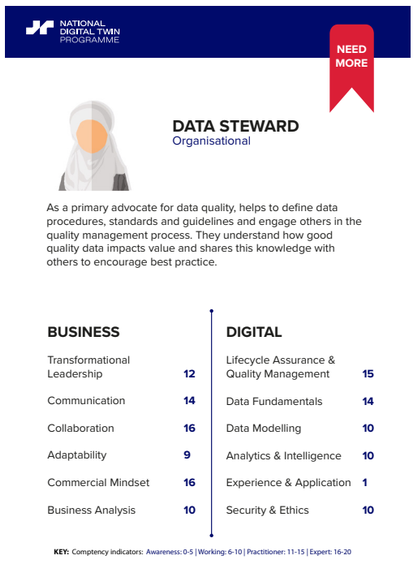
- skills to develop (as identified in self-assessment)
- learning mindset understood
- career pathway chosen.

This is an example of a training plan chosen by an individual performing the role of a Data Steward. Within the training register, individuals are able to filter training materials related to their level of competency and based on individual learning style preferences.

The training register also includes the following filters, recognising individual circumstance such as time to dedicate and financial support.

Additional filters:

- cost
- time
- delivery mechanism
- provider.



Skill Areas	Transformational Leadership	Communication	Collaboration	Adaptability	Commercial Mindset	Business Analysis
Competency level	Practitioner	Practitioner	Practitioner	Working	Expert	Working
Business	Enhancing coaching with psychology and neuroscience	How your brain responds to stories — and why they're crucial for leaders	Building high-performing teams	Building resilience	Strategic workforce planning for people professionals	Data-driven decision making (DDDM)
	The pyramid of purpose	The art of influencing	Blanchard's ABCD model of trust	Raise your resilience: transform stress into a pressure you can thrive on	Advanced business strategy	Data-driven decision making
	The 5 leadership mindsets for future success	Influencing people	How to collaborate successfully	The growth mindset		Business analytics for decision making
	Key leadership skills	Negotiating and influencing skills for leaders	Essential interpersonal skills	Management of uncertainty: leadership, decisions and action		The critical thinking workshop
	Data-driven leadership skills	Inspiring and motivating individuals	What gives teams the edge?	Adaptability: the key skill needed for change		Operations analytics
	Designing and implementing your coaching strategy	Conflict resolution skills	Introduction to negotiation			

Skill Areas	Lifecycle Assurance and Quality Management	Data Fundamentals	Data Modelling	Analytics and Intelligence	Experience and Application	Security and Ethics
Competency level	Practitioner	Practitioner	Working	Working	Awareness	Working
Digital	Information lifecycle management	Data science ready	Data modelling essentials	Strategic data skills	Introduction to UX and accessible design	Introduction to data ethics and the data ethics canvas
	BCS certificate in modelling business processes	Essentials of data literacy	Predictive modelling, model fitting, and regression analysis	Analysing data with Microsoft PowerBI	UX for beginners: a crash course in 100 short lessons	Cybersecurity essentials
	Managing data quality	Data collection techniques	Taxonomies and controlled vocabularies	Cluster analysis, association mining, and model evaluation	Introduction to user experience principles and processes	Introduction to cyber security
	Data life cycle management	Foundations of intelligent information management	Taxonomy and metadata	Implementing a business intelligence solution		IT fundamentals for cybersecurity
	Certified strategic modelling facilitator		Systems modelling	Data analytics fundamentals		Learning from major cyber security incidents
	BSI diploma in quality management		Introduction to linked data and the semantic web	Working level for business analysts		Information security

Example

Data Custodian training plan

Prerequisites to developing a training plan:

- skills to develop (as identified in self-assessment)
- learning mindset understood
- career pathway chosen.

This is an example of a training plan chosen by an individual performing the role of a Data Custodian. Within the training register, individuals are able to filter training materials related to their level of competency and based on individual learning style preferences.

The training register also includes the following filters, recognising individual circumstance such as time to dedicate and financial support.

Additional filters:

- cost
- time
- delivery mechanism
- provider.

Skill Areas	Transformational Leadership	Communication	Collaboration	Adaptability	Commercial Mindset	Business Analysis
Competency level	Awareness	Working	Awareness	Awareness	Awareness	Awareness
Business	Essential people skills for line managers	How your brain responds to stories — and why they're crucial for leaders	Collaborate to perform	Building resilience	Business strategy and decision-making skills	Data-driven decision making (DDDM)
	Introduction to coaching	The art of influencing	Teamwork skills: communicating effectively in groups	Raise your resilience: transform stress into a pressure you can thrive on	Foundations of business strategy	Data-driven decision making
		Influencing people	High performing teams in a disruptive age	The growth mindset		Business analytics for decision making
		Negotiating and influencing skills for leaders	Building trust	Management of uncertainty: leadership, decisions and action		The critical thinking workshop
		Inspiring and motivating individuals	Emotional and social intelligence	Adaptability: the key skill needed for change		Operations analytics
		Conflict resolution skills				

Skill Areas	Lifecycle Assurance and Quality Management	Data Fundamentals	Data Modelling	Analytics and Intelligence	Experience and Application	Security and Ethics
Competency level	Practitioner	Expert	Practitioner	Practitioner	Working	Working
Digital	Information lifecycle management	Data collection techniques	Practical knowledge modelling: ontology development 101	Strategic data skills	Understanding user needs	Introduction to data ethics and the data ethics canvas
	BCS certificate in modelling business processes	Foundations of intelligent information management	Ontologies for business analysis	Analysing data with Microsoft PowerBI	Evaluating designs with users	Cybersecurity essentials
	Managing data quality		Information and data modelling for the enterprise	Cluster analysis, association mining, and model evaluation	UX design: From concept to prototype	Introduction to cyber security
	Data life cycle management		Models and modelling	Implementing a business intelligence solution	UX research at scale: surveys, analytics, online testing	IT fundamentals for cybersecurity
	Certified strategic modelling facilitator		RDF and OWL: the powerful duo	Data analytics fundamentals	User experience capstone	Learning from major cyber security incidents
	BSI diploma in quality management			Working level for business analysts	About face: the essentials of interaction design	Information security

Example

Data Producer training plan

Prerequisites to developing a training plan:

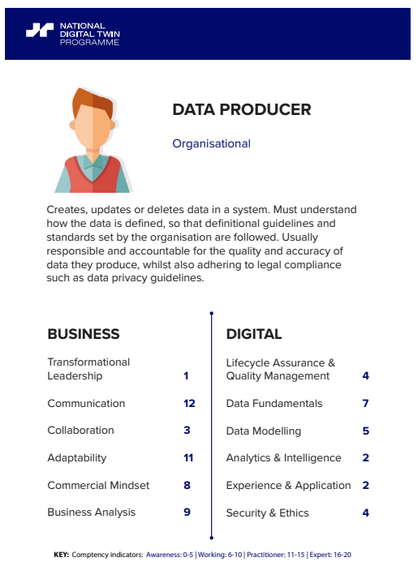
- skills to develop (as identified in self-assessment)
- learning mindset understood
- career pathway chosen.

This is an example of a training plan chosen by an individual performing the role of a Data Producer. Within the training register, individuals are able to filter training materials related to their level of competency and based on individual learning style preferences.

The training register also includes the following filters, recognising individual circumstance such as time to dedicate and financial support.

Additional filters:

- cost
- time
- delivery mechanism
- provider.



Skill Areas	Transformational Leadership	Communication	Collaboration	Adaptability	Commercial Mindset	Business Analysis
Competency level	Awareness	Practitioner	Awareness	Practitioner	Working	Working
Business	Essential people skills for line managers	How your brain responds to stories — and why they're crucial for leaders	Collaborate to perform	Building resilience	Business strategy and decision-making skills	The myths and paradoxes of innovation
	Introduction to coaching	The art of influencing	Teamwork skills: communicating effectively in groups	Raise your resilience: transform stress into a pressure you can thrive on	Foundations of business strategy	Strategic workforce planning
		Influencing people	High performing teams in a disruptive age	The growth mindset	Critical thinking skills for the professional	The critical thinking workshop
		Negotiating and influencing skills for leaders	Building trust	Management of uncertainty: leadership, decisions and action	Strategic management and innovation specialisation	Operations analytics
		Inspiring and motivating individuals	Emotional and social intelligence	Adaptability: the key skill needed for change		
		Conflict resolution skills				

Skill Areas	Lifecycle Assurance and Quality Management	Data Fundamentals	Data Modelling	Analytics and Intelligence	Experience and Application	Security and Ethics
Competency level	Awareness	Working	Awareness	Awareness	Awareness	Awareness
Digital	Information management fundamentals	Big picture: enterprise data management	Data modelling essentials	Digital skills: web analytics	Introduction to UX and accessible design	Introduction to data ethics and the data ethics canvas
	Introduction to data validation	Evidence and data collection for problem solving	Taxonomy and metadata	Data science and visualization with David Robinson	UX for beginners: a crash course in 100 short lessons	TED Talk: why cybersecurity is important
	Data quality fundamentals	Data fluency: exploring and describing data	Systems thinking and practice	Bringing data science to the enterprise with Dr. Katie Sasso	Introduction to user experience principles and processes	Cyber security awareness and the essentials of GDPR
	Data excellence for business value	Essentials of data literacy	Systems modelling	Data analytics for absolute beginners: a deconstructed guide to data literacy		
	Governance and data quality management	Visualisation: visual representations of data and information	Connecting data, decentralizing the web, making it sustainable: can the semantic web do this?			
	Data architecture, lifecycle and applications	Downloading a digital mindset	From semantics and SEO to knowledge graphs, and back again			

Examples - national role

Benefits Manager training plan

Prerequisites to developing a training plan:

- skills to develop (as identified in self-assessment)
- learning mindset understood
- career pathway chosen.

This is an example of a training plan chosen by an individual performing the (national) role of Benefits Manager. Within the training register, individuals are able to filter training materials related to their level of competency and based on individual learning style preferences.

The training register also includes the following filters, recognising individual circumstance such as time to dedicate and financial support.

Additional filters:

- cost
- time
- delivery mechanism
- provider.

Skill Areas	Transformational Leadership	Communication	Collaboration	Adaptability	Commercial Mindset	Business Analysis
Competency level	Working	Practitioner	Expert	Expert	Practitioner	Practitioner
Business	Leadership and emotional intelligence	Storytelling and influencing: communicate with impact	High performance collaboration: leadership, teamwork, and negotiation	Organisational design	Advanced business strategy	The myths and paradoxes of innovation
	The future of leadership: developing a new perspective	The art of influencing		Leading change	Critical thinking skills for the professional	Strategic workforce planning
	Mission statements and vision statements	Influencing people		High stakes leadership: leading in times of crisis	Strategic management and innovation specialisation	The critical thinking workshop
	Key leadership skills					Operations analytics
	Data-driven leadership skills					
	Designing and implementing your coaching strategy					

Skill Areas	Lifecycle Assurance and Quality Management	Data Fundamentals	Data Modelling	Analytics and Intelligence	Experience and Application	Security and Ethics
Competency level	Practitioner	Working	Awareness	Awareness	Working	Awareness
Digital	Business process modelling A-Z: learn BPMN 2.0 from scratch	Big picture: enterprise data management	Data modelling essentials	Digital skills: web analytics	Understanding user needs	Introduction to data ethics and the data ethics canvas
	Introduction to data validation	Evidence and data collection for problem solving	Taxonomy and metadata	Data science and visualisation with David Robinson	Evaluating designs with users	TED Talk: why cybersecurity is important
	Data quality fundamentals	Data fluency: exploring and describing data	Systems thinking and practice	Bringing data science to the enterprise with Dr. Katie Sasso	UX design: from concept to prototype	Cyber security awareness and the essentials of GDPR
	Data excellence for business value	Essentials of data literacy	Systems modelling	Data analytics for absolute beginners: a deconstructed guide to data literacy	UX research at scale: surveys, analytics, online testing	
	Governance and data quality management	Visualisation: visual representations of data and information	Connecting data, decentralising the web, making it sustainable: can the semantic web do this?		User experience capstone	
	Data architecture, lifecycle & applications	Downloading a digital mindset	From semantics and SEO to knowledge graphs, and back again		About face: the essentials of interaction design	

Example

Policy Maker training plan

Prerequisites to developing a training plan:

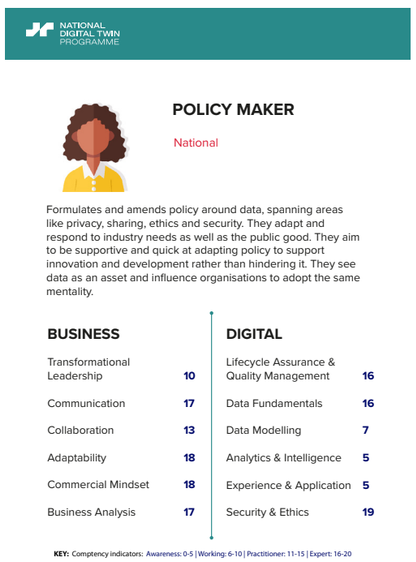
- skills to develop (as identified in self-assessment)
- learning mindset understood
- career pathway chosen.

This is an example of a training plan chosen by an individual performing the (national) role of a Policy Maker. Within the training register, individuals are able to filter training materials related to their level of competency and based on individual learning style preferences.

The training register also includes the following filters, recognising individual circumstance such as time to dedicate and financial support.

Additional filters:

- cost
- time
- delivery mechanism
- provider.



Skill Areas	Transformational Leadership	Communication	Collaboration	Adaptability	Commercial Mindset	Business Analysis
Competency level	Working	Expert	Practitioner	Expert	Expert	Expert
Business	Leadership and emotional intelligence	Storytelling and influencing: communicate with impact	High performing teams in a disruptive age	Organisational design	Business strategy and decision making skills	Strategic workforce planning
	The future of leadership: developing a new perspective	The art of influencing	Blanchard's ABCD model of trust	Leading change	Foundations of business strategy	
	Mission statements and vision statements	Influencing people	How to collaborate successfully	High stakes leadership: leading in times of crisis	Critical thinking skills for the professional	
	Key leadership skills		Essential interpersonal skills		Strategic management and innovation specialisation	
	Data-driven leadership skills		What gives teams the edge?			
	Designing and implementing your coaching strategy		Introduction to negotiation			

Skill Areas	Lifecycle Assurance and Quality Management	Data Fundamentals	Data Modelling	Analytics and Intelligence	Experience and Application	Security and Ethics
Competency level	Expert	Expert	Working	Awareness	Awareness	Expert
Digital	BCS certificate in modelling business processes	Data collection techniques	Data modelling essentials	Digital skills: web analytics	Introduction to UX and accessible design	CCNA security
	Managing data quality	Foundations of intelligent information management	Predictive modelling, model fitting, and regression analysis	Data science and visualisation with David Robinson	UX for beginners: a crash course in 100 short lessons	Certified information privacy manager
	Data life cycle management		Taxonomies and controlled vocabularies	Bringing data science to the enterprise with Dr. Katie Sasso	Introduction to user experience principles and processes	Certified information security manager
	BSI diploma in quality management		Taxonomy and metadata	Data analytics for absolute beginners: a deconstructed guide to data literacy		Certified information systems security professional
			Systems modelling			Certificate of cloud security knowledge
			Introduction to linked data and the semantic web			Identifying security vulnerabilities

Example

Ontologist training plan

Prerequisites to developing a training plan:

- skills to develop (as identified in self-assessment)
- learning mindset understood
- career pathway chosen.

This is an example of a training plan chosen by an individual performing the (national) role of an Ontologist. Within the training register, individuals are able to filter training materials related to their level of competency and based on individual learning style preferences.

The training register also includes the following filters, recognising individual circumstance such as time to dedicate and financial support.

Additional filters:

- cost
- time
- delivery mechanism
- provider.

Skill Areas	Transformational Leadership	Communication	Collaboration	Adaptability	Commercial Mindset	Business Analysis
Competency level	Awareness	Expert	Expert	Awareness	Working	Practitioner
Business	Essential people skills for line managers	Storytelling and influencing: communicate with impact	High performance collaboration: leadership, teamwork, and negotiation	Wellbeing and resilience at work	High performing teams in an increasingly virtual world	The myths and paradoxes of innovation
	Introduction to coaching	The art of influencing		Why adaptability is more important than ever	Blanchard's ABCD model of trust	Strategic workforce planning
		Influencing people		The agile leader	How to collaborate successfully	The critical thinking workshop
				Building resilience	Essential interpersonal skills	Operations analytics
				Raise your resilience: transform stress into a pressure you can thrive on	Building high-performing teams	

Skill Areas	Lifecycle Assurance and Quality Management	Data Fundamentals	Data Modelling	Analytics and Intelligence	Experience and Application	Security and Ethics
Competency level	Practitioner	Expert	Expert	Practitioner	Working	Practitioner
Digital	Information lifecycle management	Data collection techniques	Information and data modelling for the enterprise	Strategic data skills	Understanding user needs	Data ethics professional accreditation
	BCS certificate in modelling business processes	Foundations of intelligent information management		Analysing data with Microsoft PowerBI	Evaluating designs with users	Introduction to cyber security
	Managing data quality			Cluster analysis, association mining, and model evaluation	UX design: from concept to prototype	Identifying security vulnerabilities
	Data lifecycle management			Implementing a business intelligence solution	UX research at scale: surveys, analytics, online testing	Certified information systems security professional
	Certified strategic modelling facilitator			Data analytics fundamentals	User experience capstone	Certified information privacy professional (Europe)
	BSI diploma in quality management			Working level for business analysts	About face: the essentials of interaction design	Certified secure software lifecycle professional

Measure up and check up

Assess skill level and learning mindset

Measure up

Research into effective adult learning shows that learners need to understand their strengths and development opportunities. Providing them with concrete information enables them to identify the changes needed to enhance their performance and the motivation to engage in their learning.

This method of measuring current ability was selected to enable individual users of this Capability Enhancement Programme to assess their current strengths and development areas compared to what is required for their chosen role and fill specific gaps with applicable training.

Learning mindset is also measured to help learners understand and focus on ways that will help them get the most out of their learning.

Check up

Learners are encouraged to regularly re-use the assessment to determine where they are on their learning journey.

This is because learners need feedback to identify progress and plan for any long term changes in behaviour. The learner may get an additional perspective from their own assessment of development.

We would encourage learners to check in with both their peers and line managers to gain a 360 degree view of their current strengths and development areas. This should plug any gaps in self-awareness that people may have.

Self-assessment explained

Learners will be asked to rate themselves on a scale from 'awareness' to 'expert' to assess where they need to prioritise their learning in relation to what is required in their role.

Collecting information through a self-assessment has some limitations. People are often biased when they report on their own knowledge and experiences. For example, many individuals are either consciously or unconsciously influenced by 'social desirability' (i.e. more likely to report experiences that are considered to be socially acceptable or preferred). They may also lack the introspective ability to accurately assess their strengths and development areas.

The self-assessment contains a column for individuals' line manager to fill out to ensure individuals get an independent perspective of their current skills. This automatically generates an average score.

If individuals generally score higher on business skills, they may be more suited to taking the generalist pathway. If individuals score higher on the digital skills, they may be more suited to taking the specialist pathway.

Category	Competencies	Self-assessment	Manager assessment	Average (auto-generated)	Required level for desired role (enter based on framework)	Gap (auto-generated)	Comments (where applicable)	Training done?
Business Skill Areas	**Commercial Mindset**	4	2	3	4	1		No
	Business Analysis							No
	Transformational Leadership							No
	Communication							No
	Collaboration							No

Figure 7: Partial example of self assessment

When compared with the level necessary for their chosen role, the 'gap' column automatically generates a score from -3 to 3. Any 'gap' score below zero will be highlighted in red. These are the competencies that individuals should focus on first in their training plan.

Tools

Maximise opportunities to apply learning

Social learning

How individuals learn from others and how others learn from individuals.

This learning happens outside of the 'classroom' or workshop and is where the learning is applied to the real world and real issues. This is extremely valid when looking to develop information management capability because information is used in almost every situation and having quality information is a challenge.

For example, from a role point of view, if 'collaborate' is critical in a role, social learning is an opportunity to develop this competence while learning to apply newly acquired skills.

- Think about collaborating with others on projects, discussion groups, peer communities or running your own workshops and seminars.

Other ways to maximise social learning includes being engaged and involved in the Digital Twin Hub community and other professional online communities that provide opportunities to learn from others facing similar challenges.

Deliberate practice

Practice makes permanent - for practitioner and expert levels of competence, it is important that immediately after acquiring new knowledge or skill, that this is applied through deliberate and purposeful practice.

Learning logs

Reflection is a critical part of learning that is often over-looked under pressure of moving on to the next task or activity. Consider keeping a learning log that helps you understand whether you are:

- learning 'safely' or stretching yourself
- asking for specific feedback against gaps you have identified
- prioritising the right skills that need learning and unlearning
- deliberately practising the right skills.

Social learning explained

We've known since the work of Ebbinghaus in the late 1800s that **42%** of what is learned is forgotten within twenty minutes. One month later, **79%** is lost. More recently, research from Bersin and Associates indicates that learners retain a mere **5%** of what they hear and just 10% of what they read. But when learners become more actively involved and learn together, the amount they retain increases greatly. When learners study alone, they typically remember **28%** of what they learned after two days. But when they work with the materials and interact and learn with others, they remember **69%**. According to Bersin, the reason is because "conceptualising, recalling, and using information creates the 'memory pathways' that stick in your mind".

Technical material percentage retained two weeks later

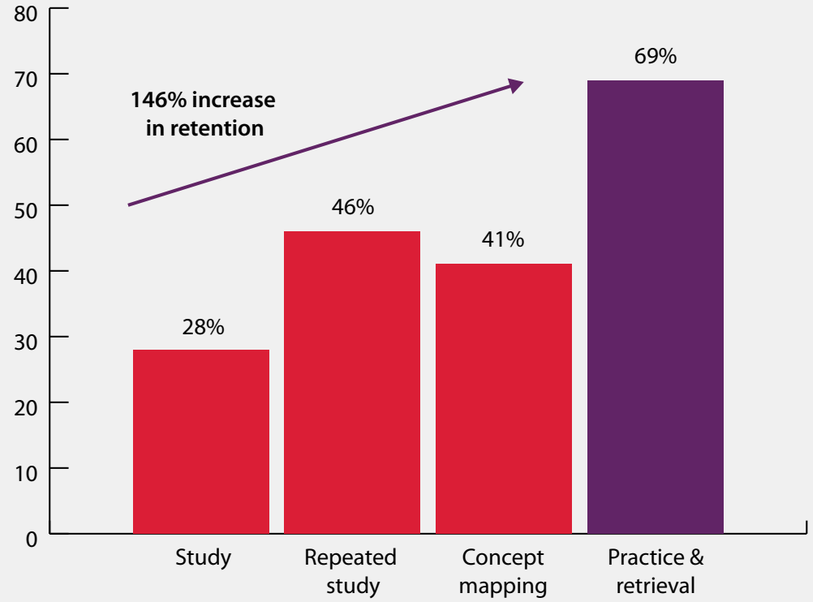


Figure 8: Bersin, J., 2019. The Power of Collaborative Learning: More Important Than Ever. [online] JOSH BERSIN. Available at: <https://joshbersin.com/2019/05/the-power-of-collaborative-learning-more-important-than-ever/> [Accessed 23 March 2021].

These significant improvements in retention and learning are a function of social learning. According to this theory, we model our behaviour based on our interactions with the people around us. The more we share in common with others, the more likely we are to learn from each other.

In the context of adults in the workplace, social learning includes the informal ways that we learn from our colleagues. We do this all the time – in regular meetings, when we are problem solving in teams and in coffee break catch-ups. What we often miss is doing this formally and maximising the impact of social learning by reinforcing and applying what we have learned in practice.

Appendix

Definitions

Business Skill Areas

Adaptability

Adopts a learning mindset to continually innovate and develop agile skills, demonstrates resilience in the face of setbacks and resistance to change.

Business Analysis

Monitors, analyses, evaluates and interprets data to create useful information to solve problems; understanding and managing the risk/reward ratio and operating within an ethical code of conduct.

Collaboration

Builds trusting relationships to maximise the value of data and what is shared (data and accompanying models and standards), recognising the broader impact of interoperability of data assets.

Commercial Mindset

Demonstrates an understanding of commercial decision points and key performance indicators, being able to build a business case for where data management and sharing could drive better commercial outcomes including financial and societal gains.

Communication

Listens effectively to others to understand data management challenges and data requirements, and articulates clearly and compellingly the case for better information management and better quality data in order to secure organisational commitment.

Transformational Leadership

Appreciates and champions the value of data and digital assets and their importance to fulfil real world purpose and the vision of the NDT. Driving cultural change by empowering self and others to change their mindset and approach.

Digital Skill Areas

Analytics and Intelligence

Is able to specify quality requirements needed of data being produced and analysed. Can structure and analyse data using statistical analysis and other data science methods to inform data comprehension. Uses visualisation and sense-making techniques to improve data interpretation and aid decision-making.

Data Fundamentals

Demonstrates the ability to create, use and communicate data in context. Articulates an understanding of data definitions and methods (data literacy); knows what good quality data looks like and can articulate the purpose and value of using it, whilst recognising how to generate value and make decisions with it.

Data Modelling

Takes a systems-thinking and logical approach to plan, design, manage and optimise the flow of data, demonstrating clear understanding of engineering semantics such as ontologies, associated taxonomies and reference data. Recognises these concepts in relation to their broader impact on data sharing, interoperability and connected digital twins.

Experience and Application

Crafts intuitive and engaging user experiences through user research and testing. Demonstrates an understanding of user interface design, facilitation and people to bridge the gap between data, technology and users - making technology more applicable and accessible.

Lifecycle Assurance and Quality Management

Understands how the relationship between lifecycle management, process modelling and data quality informs information requirements and data quality improvements. Embodies a quality improvement culture with targets to build trust and transparency of the processes and outcomes associated with data including its value and purposeful fit for informed decision making..

Security and Ethics

Acts as a governing and compliance authority to inform how data is used. Embodies a secure by design approach to cyber security, promoting security mindedness and business continuity. Considers data decisions in context of business integrity and ethics whilst ensuring data privacy and legal obligations are adhered to.

Please refer to the Skills and Competency Framework for further details.

Security Mindedness

Security-minded is defined as understanding and routinely applying appropriate and proportional security measures in any business situation to deter and/or disrupt hostile, malicious, fraudulent and criminal behaviours or activities. It is a holistic approach, taking into consideration personnel, physical, cyber and cross-cutting security, overseen by good governance with clear lines of responsibility and accountability (Centre for Digital Built Britain, 2021)

Appendix

Competency indicators

Awareness

You know about the skill and have an appreciation of how it is applied in a practical situation.

Working

You can apply your knowledge and experience of the skill, including tools and techniques. You can adopt those most appropriate for the situation.

Practitioner

You know how to share your knowledge and experience of this skill with others, including tools and techniques. You can define those most appropriate for the situation.

Expert

You have both knowledge and experience in the application of this skill. You are a recognised specialist and adviser in this skill including generation of new practices, methods and tools. You can lead or guide others in following best practice.

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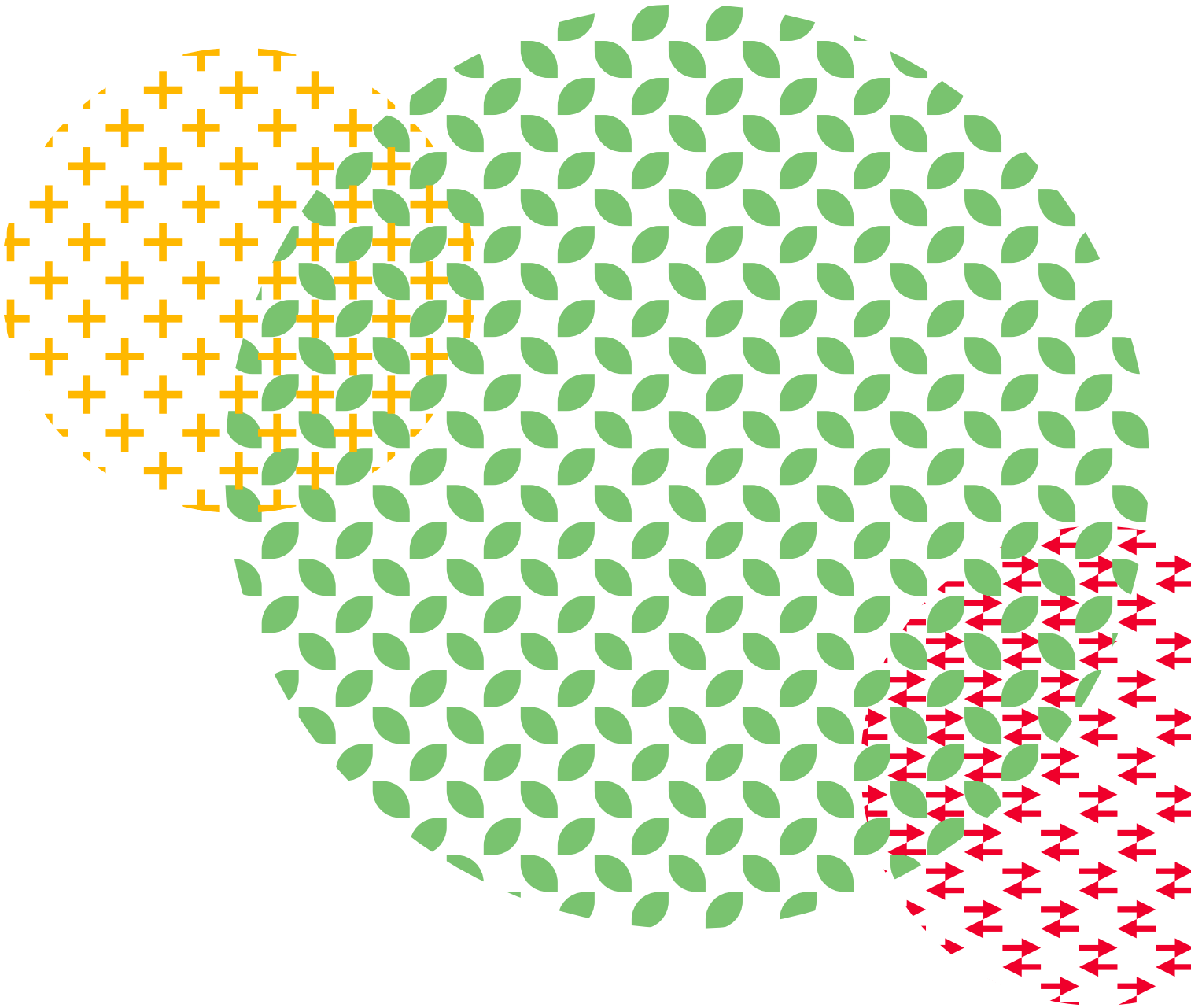

This research forms part of the Centre for Digital Built Britain's (CDBB) work at the University of Cambridge within the Construction Innovation Hub (the Hub). The Hub is funded by UK Research and Innovation through the Industrial Strategy Fund.

CONSTRUCTION INNOVATION HUB

INDUSTRIAL STRATEGY

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