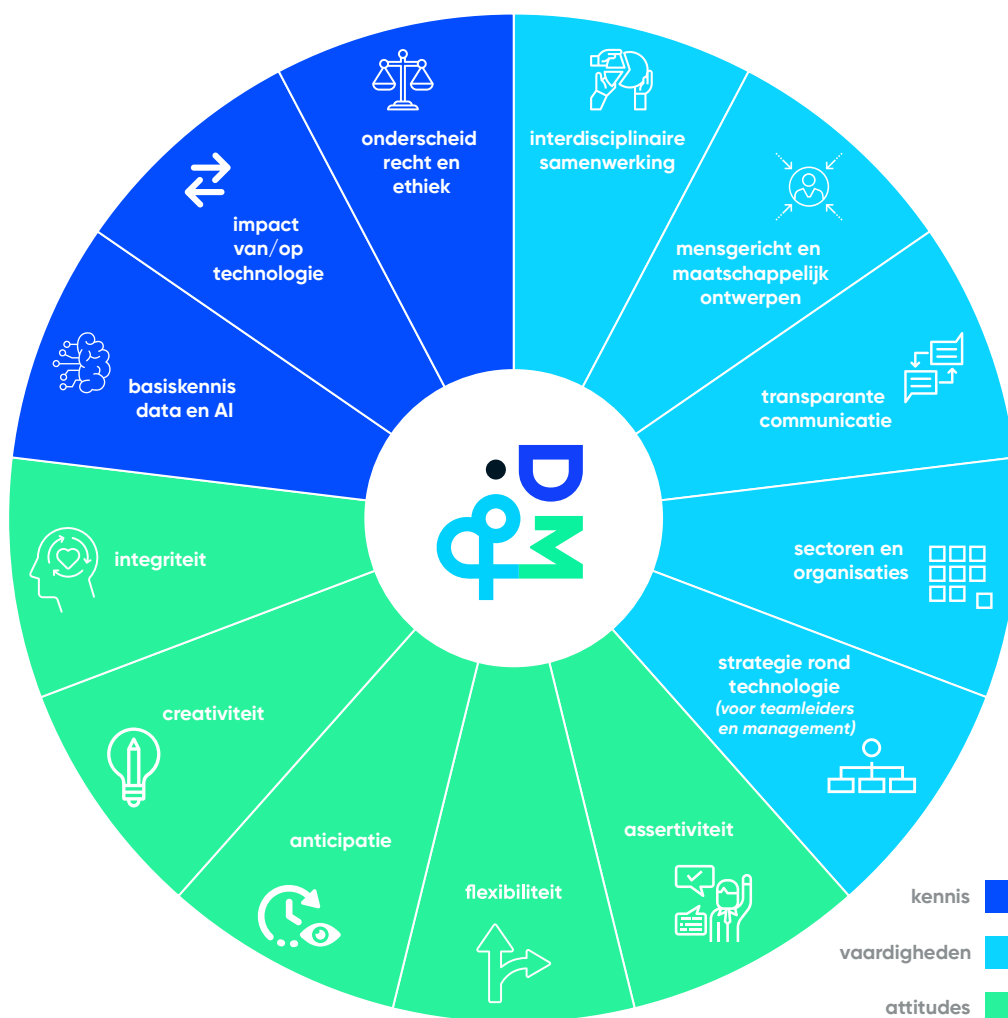


WHICH SKILLS ARE NEEDED TO

DEVELOP RESPONSIBLE SYSTEMS?

A competency model for achieving responsible data-driven systems and artificial intelligence.



Which competencies does a team need to develop responsible data-driven systems and artificial intelligence (AI)? The competency model 'Skilfully developing data-driven systems' helps you answer this question. It explains the necessary knowledge, skills and attitudes of employees who design and develop technological innovations.

In this explanatory document, we take a closer look at the use and composition of the model, which contains 3 categories, 13 competency groups and 43 competencies.

WHY HAVE WE DEVELOPED THIS COMPETENCY MODEL?

The development of responsible data-driven systems and AI is not a task for one person. Instead, an entire **team** works together to make the right choices that lead to a sustainable, accurate and user-friendly system. The responsibility for this lies not only with the team developing these technologies, but also with the team leader(s) and management, who influence the development process. Is there room for employees to question choices and decisions? Do employees receive enough support, such as training, to develop responsible technological innovations?

This competency model encourages teams and organisations to look at which **knowledge, skills and attitudes** are available so that everyone complements each other, but also to get a picture of which competencies are less present within the organisation. As a result, the [Knowledge Centre Data & Society](#) hopes to contribute to the debate on the development of technologies, and especially how this can be done in a responsible way.

WHAT IS THE COMPETENCY MODEL AND WHO CAN USE IT?

The competency model shows which competencies employees need in order to develop and/or use data-driven systems in a socially responsible and legally compliant way. The model is **dynamic** and can be used for **various purposes**:

- Not every team member is expected to have all the competencies in the model, but the team as a whole should. A **team leader** can, for example, use the model to see which competencies are less (or not) present in the team. This might inspire the team leader to recommend **further training or retraining** courses to team members or to take on **new employees** who can strengthen the team.
- In a **recruitment or development interview** between a (potentially new) employee and a **human resources manager**, the model can serve as a guide to gauge **current knowledge and skills**, but also **interest in further training**.

HOW IS THE MODEL COMPOSED?

The model contains **3 categories**: knowledge (dark blue), skills (light blue) and attitudes (green). The knowledge and skills categories refer to what you need to know and be able to do to develop responsible technological innovations. The attitudes category describes personal attitudes, beliefs and ambitions that are important for the development of such innovations, but are also of general interest.

We describe the different competency groups for each category and elaborate on the specific competencies needed to develop responsible data-driven systems and AI (see boxes).

CATEGORY KNOWLEDGE

To develop responsible technological innovations, the team must have a great deal of **theoretical information**. This information translates into in-depth knowledge in **3 competency groups**.



1. Basic knowledge of data and AI

Employees have an understanding of data-driven systems and AI, their characteristics and added value. Technical expertise is not required, but it is important to have a basic understanding of how such systems work.

- I recognise the importance of **qualitative data** to remove bias from a data-driven system.
- I am familiar enough with various **types of AI applications** to be able to assess which purposes a (type of) AI application is relevant for.



2. Impact of/on technology

Employees understand and correctly assess the mutual influence between a technology and its environment (e.g. society, organisation, economy).

- I know which **social and economic factors** (e.g. zeitgeist, values and norms, policy framework) influence a technology in order to estimate what might play a role in the acceptance and use of a technology.
- I have insight into the **(energy) efficiency** of a technology to correctly assess its impact on the environment and society.
- I know how someone (e.g. users, developers, investors) can **use (and misuse) a technology differently** than initially foreseen in order to anticipate this if necessary.
- I am **aware of my role, the role of my team and of the way my organisation works** on the development of technology in order to take this into account in the design, development and implementation process.



3. Distinction between law and ethics

Employees understand (the difference between) law and ethics, the benefits of both, their translation into derivatives, their degree of enforceability, and their influence on the development and use of technology.

- I know the **different legal and ethical options** for regulating behaviour around the use of technology.
- I know the main **legal frameworks** (e.g. GDPR, consumer protection, liability law) that can influence the development of technology in order to verify if a technology complies with the regulation.
- I know the main **ethical theories** (e.g. virtue ethics, consequentialism, duty-based ethics) and **lists of principles** (e.g. AI HLEG's Ethical Guidelines for Trustworthy AI, UN's SDGs, Council of Europe's Principles of Good Governance) important for technology development in order to evaluate whether and to what extent a technology takes ethical principles into account.

CATEGORY SKILLS

Besides theoretical knowledge, a team must also be able to apply this knowledge in **practical and work-related situations**. To strengthen their skills, practice is required. In other words, the more experience a team has in performing actions or tasks, the stronger the skills will be. The practical knowledge is spread over **5 competency groups**, of which the last competency group is mainly aimed at team leaders and/or management.



1. Interdisciplinary cooperation

Employees invest in goal-oriented partnerships with other team members or people with a different professional background, without neglecting themselves or their own areas of expertise.

- I can **empathise with people from different professional backgrounds** to reach a common solution.
- I explain **technical jargon and domain-specific challenges** in an understandable way to my team members to avoid misunderstandings and miscommunication within the team.
- I recognise the **strengths and weaknesses of my team members and myself** to determine which tasks are more/less appropriate for a person.
- I know someone (in or outside my organisation) who has **legal, ethical and/or social expertise** to guide our team if needed.



2. People-centred and socially responsible design

Employees include the perspectives, attitudes and thresholds of various stakeholders (e.g. end users, developers, data scientists) in the development process of a technology, and regularly verify the technology against the wishes, needs and current zeitgeist.

- I use **participatory methods and user research** (e.g. interview, focus group, survey, workshop) to identify various barriers to the acceptance and use of a technology.
- I create a **clear problem definition** on the basis of the identified thresholds to come up with solutions for those specific problems.
- I carry out an **ethical impact analysis** of a technological innovation to identify the ethical pitfalls and opportunities of a technology.
- I use **creative brainstorming techniques** to think of solutions and ideas for the identified problems.
- I use (ethical/legal) **tools, frameworks and/or canvases** to solve ethical, legal and social issues around technology, data and AI.
- I test a **(simplified) prototype** with end users to evaluate and adapt a technology according to their feedback and needs.
- When it appears that a technology does not work well (for the end users), I take the **necessary measures** to improve it or if necessary take it off the market.



3. Transparent communication

Employees communicate openly and clearly with end users and other stakeholders about a technology, how it works and how it was developed, as well as about possible explanations if it turns out that a technology does not live up to its promise.

- I **log the decisions made in the development process** of a technology to justify certain choices in the design process to the end users or other stakeholders.
- I can **clearly explain a technology, how it functions and the data that feeds it** to end users so they can make an informed choice about whether to buy and use a technology.
- I can give a **clear explanation about why a technology does not meet the promised standard** and how the organisation will resolve this so confidence in the technology and organisation is not lost.



4. Sectors and organisations

Employees actively monitor relevant sectors and organisations to have a good idea of the current knowledge and (best) practices regarding the development of responsible data-driven systems and AI.

- I **follow up on key organisations** (e.g. authorities, regulators, [inter]national actors, [knowledge] institutions) **and their achievements** in order to have a better view on focus points, pressing issues and most recent developments.
- I keep myself informed about the **main subsidy channels and support measures** available for developing and implementing a technology.
- I am in **regular contact with relevant organisations** to ask questions, exchange ideas and share best practices.



5. Strategy on technology

Team leaders and/or management actively guide the setting up of structures for ethical development and the introduction of a technology within the organisation. They take the necessary actions to streamline this process in a participatory way at both employee and organisational levels.

- I explore the **opportunities and risks** associated with the use of a technology in order to make an informed decision on the added value of a technology for my project.
- I correctly **assess the organisational and economic opportunities and risks** of a technology to take into account the impact on my organisation and employees.
- I **involve management, employees and social partners** in the possible introduction of a technology to the organisation in order to steer changes at organisational and employee level in the right direction.
- I set up **structural ethical initiatives in the organisation** (e.g. code of ethics, ethics steering committee) to support the responsible development of technology and to monitor the (to be) made choices in the design and development process.
- I **translate ethical principles into specific (technical) tasks and roles** on the work floor, for example conducting an audit or checking the accuracy of the system.
- I guide colleagues towards **retraining and additional training** in order to deepen their knowledge and skills.
- If necessary, I carry out a **reorganisation** (focusing on job quality, participation and inclusion) to ensure the well-being of employees.

CATEGORY ATTITUDES

The attitudes of the team members, such as their personal **emotions, thoughts, beliefs** and their position regarding a technology, the organisation and society in general, also influence the development of responsible technological innovations. Values, norms, personal ambitions and motivation determine the attitudes of a team. The attitudes include **5 competency groups** that are not just important, but essential for the development of technology.



1. Assertiveness

Employees dare to speak up in a team and bring difficult or undesirable situations to the attention of a team leader.

- I **speak up if I disagree with the direction my organisation is taking** to avoid misunderstandings, mistakes and unethical choices.
- I **make difficult decisions and do not postpone decisions or actions** unnecessarily in order to ensure project completion and to learn from mistakes.



2. Flexibility

Employees adapt readily to new situations and changing contextual factors.

- I **quickly adapt to changing circumstances** (e.g. reorganisation, new colleagues) in order to easily cope with new developments.
- I **learn proactively and stay up to date** with the rapidly changing technology sector.



3. Anticipation

Employees respond in a timely way to difficult situations, act proactively and look ahead to limit possible risks.

- I **anticipate critical situations in time** to prevent things from getting out of hand.
- I **look ahead and estimate necessary risks, actions and decisions** in order to anticipate issues.



4. Creativity

Employees think of original and atypical ideas to solve problems.

- I **try out other approaches** than those already in place to respond to problems in an innovative way.
- I **think of innovative solutions** that appeal to others in order to respond to all (opposing) demands and problems.



5. integrity

Employees guard their own social and ethical standards and behave accordingly at all times.

- I **comply with generally accepted social and ethical standards** in order to develop an ethical technology.
- I **handle sensitive and personal information carefully** so as not to harm others.

WHAT IS THE VALUE OF THE MODEL?

The competency model is a snapshot of relevant competencies that a team of employees must have in order to develop responsible technological innovations. The list of competencies is not exhaustive, but represents some core competencies that are important in the responsible development of a technology.

We strongly encourage human resources managers and team leaders to adapt this generic model to their own needs and wishes and to give it their own (organisational) emphasis so it better aligns with their own ways of working.

The competency model is therefore also available under a [CC by 4.0 licence](#) so that others can continue to build on this work.

HOW WAS THE MODEL DEVELOPED?

The model was shaped by starting with a benchmark of existing competency models, followed by interviews with experts, a test of the model with end users in workshops, and the further shaping of the model into the final result.

1. Benchmark

We analysed a number of existing competency models related to technology development, and also looked at competency models with a different content focus. In order to incorporate lessons learned into our competency model, we mainly looked at the approach, content, structure and design of these models.

2. Expertise

After this, we set up an advisory group from the technology and education sectors. They met 5 times in total and were given the opportunity to review the content of the model and make adjustments. They gave

direction to the model and guided us in keeping in mind the purpose and intended target group of the model.

The advisory group consisted of:

- Hans Arents (Digitaal Vlaanderen - *Digital Flanders*)
- Mathias Vercauteren (Ethical Technology Institute)
- Veerle De Marez (VIVES Business School Brugge)
- Pieter Caris (VAIA)
- Tomas van den Broeke (Technopolis Group)
- Tomas Folens (VIVES)
- Jelle Hoedemaekers (Agoria)
- Dieter Somers (Voka)

The model was also presented to a dozen specific job profiles (e.g. designers, data scientists, ethicists) who are involved in the development of a technology. They were asked to look at the content of the model and provide feedback (e.g. Are certain competencies missing? Which competencies are less or more relevant?). Their remarks were included in the final version of the competency model.

3. Verification (workshops)

The competency model proposals were tested during 2 workshops. In the workshops, we asked (mainly) human resources professionals to review the content, form and use of the model against their own ways of working. After each workshop, the competency model was then adjusted based on their feedback.

The first workshop took place online on 3 December 2021 and was aimed at (1) gaining insight into the current ways of working of human resources professionals, (2) mapping out the opportunities and applications of the competency model, and (3) questioning the form and content of the model.

In order to achieve this, the participants were asked to describe an average career, and to focus mainly on the moments when human resources comes into contact with (new) employees. Then, after a brief presentation of the competency model, they were asked at which of those moments the model could

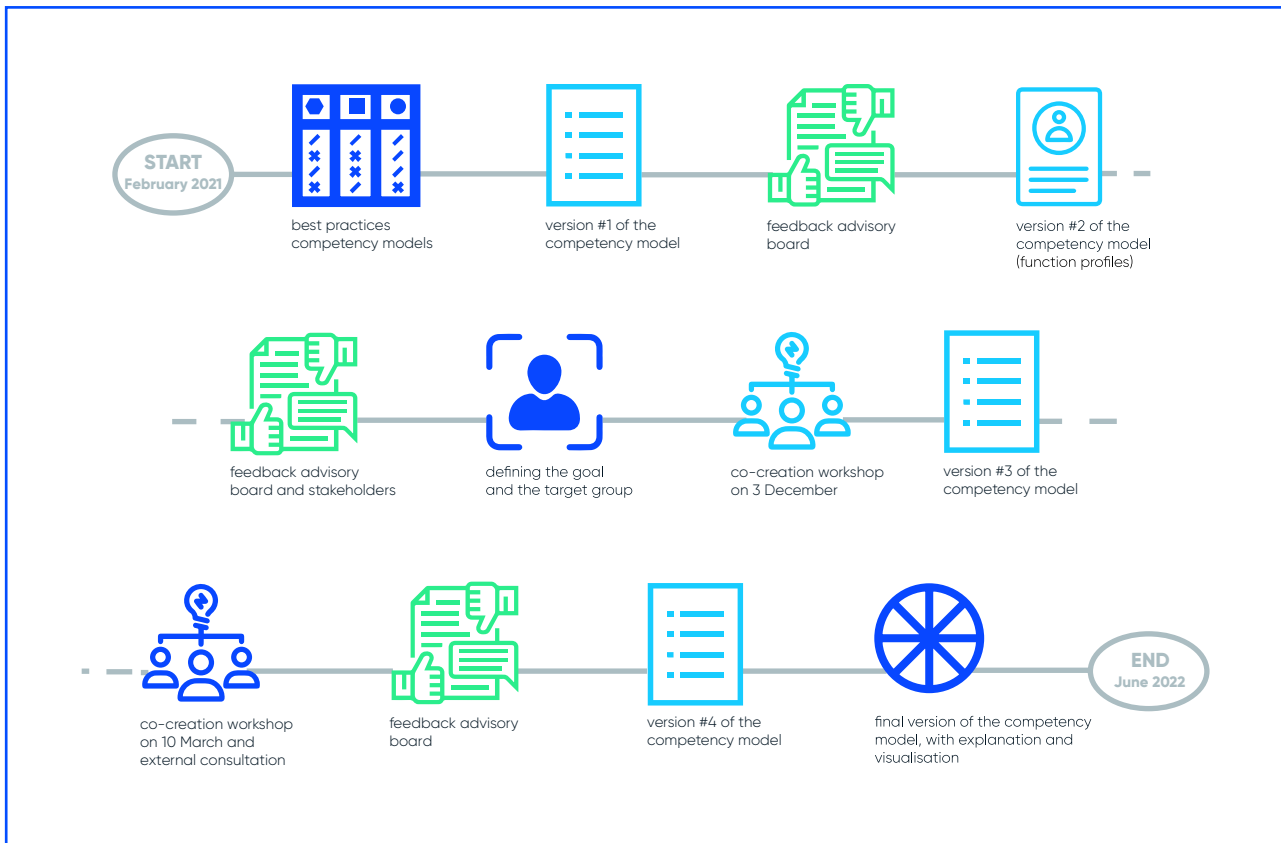


Illustration of the development process of the competency model.

support them and in what way exactly. They were also specifically asked about the required form and content of the model (e.g. assessment list, graphic presentation).

The most important insights that came out of this workshop were:

- The model is mainly of interest during recruitment/selection and development/assessment (e.g. to develop employee skills and reorientate employees).
- If the model is to be seen as a measuring instrument, then human resources professionals expect the model to be evidence-based and the competencies to be measurable (i.e. by solving puzzles, dilemmas, tests)
- If the model is to be seen as a guideline for a conversation starter, then the model must be flexible so that human resources professionals can still add their own elements, knowledge and insights to the model.
- The added value of the competency model is not so relevant on an individual level, but more so when you can use it

to put together a team for a specific project.

The second workshop took place on 10 March 2022 and was aimed at (1) questioning the content of the model, and (2) determining the form or structure of the model.

The participants were asked to take a closer look at the different competency groups (e.g. Are all competency groups [equally] relevant? Are any competency groups missing?). Then they gave feedback on all the competencies in the model (e.g. Are the competencies relevant for the development of responsible technology? Which competencies are missing?) and they could indicate their expectations about the form of the model.

The following insights emerged from this workshop:

- The model contains the competencies that are important for the development of data-driven systems and AI, but the categorisation of the competencies is not clear enough. Currently, an employee

runs the risk of being tested twice on the same competency.

- The model should contain definitions of the competency groups and categories so that it is clear to everyone what the competencies are about and whether the competencies belong to the knowledge, skills or attitudes category.

4. Making it more concrete

Based on the feedback from the advisory board, experts and workshop participants, we gave the competency model a concrete form and content. The model was published on the Knowledge Centre Data & Society's website at the end of June 2022.

The model is flexible and dynamic, and can be adjusted according to new applications, target groups or contexts. Do you have another use for the model in mind? [Let us know](#) and we will see if and how we can work together on this.

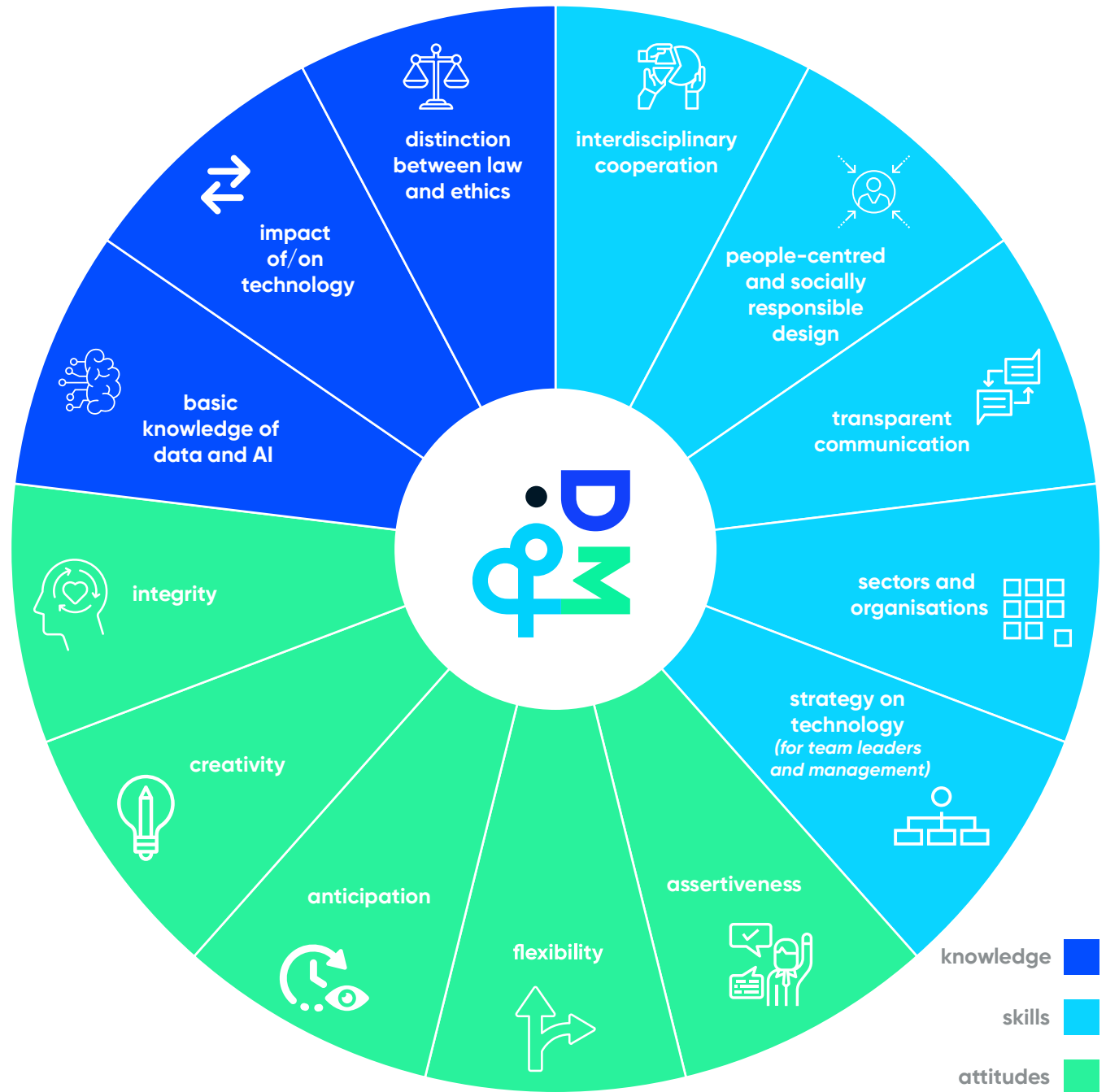
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For more information on this competency model, [visit the website of the Knowledge Centre Data & Society](#).



The Knowledge Centre Data & Society is the central hub for the legal, social and ethical aspects of data-driven and AI applications.

The Knowledge Centre is part of the Flemish Artificial Intelligence Plan and receives support from the Flemish government (EWI).

The logo for AI Flanders. It consists of a yellow rectangular background. On the right side of the rectangle, there is a small white icon of a person with arms raised. The text "AI FLANDERS" is written in bold, black, uppercase letters across the top of the yellow rectangle. Below it, the tagline "BUILDING OUR DIGITAL FUTURE" is written in a smaller, black, uppercase font.

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