TOPSECTOR ICT PRESENTS

VERSION 1.0

KIA DIGITALISATION 2024-2027

A STRATEGIC FRAMEWORK FOR PROGRAMMING KNOWLEDGE AND INNOVATION IN DIGITALISATION AND DIGITAL AND INFORMATION TECHNOLOGIES AS PART OF THE MISSION-DRIVEN TOP SECTORS AND INNOVATION POLICY IN THE NETHERLANDS

DIGITALISATION

STRATEGIC AGENDA 2024 - 2027

TABLE OF CONTENTS

DIGITALISATION

STRATEGIC AGENDA 2024 – 2027


"scripts": {
"start": "react-scripts start",
"build": "react-scripts build",
"test": "react-scripts test",
"eject": "react-scripts eject"

DEAR READER,

FOREWORD

You are looking at the first Knowledge and Innovation Agenda (KIA) for Digitalisation. This Agenda provides a framework and useful points of reference for future ICT research and innovation, and as such ultimately also for solutions to economic and social questions. The KIA Digitalisation distinguishes between three pillars that relate to Digital and Information Technologies (DITs): innovation with DITs (for the benefit of other missions), reflection on DITs (making sure that DITs are developed and applied responsibly) and innovation in DITs (fundamental knowledge development).

THE DIGITAL TRANSITION IS ONE OF THE GREAT CHALLENGES OF OUR TIME.

Topsector ICT is the initiator and coordinator behind this KIA Digitalisation, as part of the multi-annual agreements for the years 2024–2027 as recorded on 2 November 2023 in the new Knowledge and Innovation Covenant. Together with you, with partners from government organisations, academia, universities of applied sciences, the business community, innovative SMEs and social organisations, we are building our future. Knowledge and innovation are key foundation stones in that process. In the KIA Digitalisation, those foundations are supported by activities relating to human capital, valorisation and market creation, and internationalisation.

The digital transition is one of the great challenges of our time, and it is our ambition for the period ahead to contribute a key building block by all of us working together under the framework of the KIA Digitalisation. Will you join us?

For Topteam ICT,

Jeannine Peek, figurehead and chair
Inald Lagendijk, figurehead for science and academia
Frits Grotenhuis, director

CHAPTER 1

KIA DIGITALISATION: CONTEXT AND OBJECTIVES

The Knowledge and Innovation Agenda (KIA) Digitalisation outlines the challenges facing knowledge and innovation in the field of digitalisation as the basis for cross-sectoral programming for programmes and projects that contribute to the success of the mission-driven innovation policy for 2024-2027.

1.1 DIGITALISATION, ECONOMY AND SOCIETY

Digitalisation is an ongoing process that is happening all around us. It is a transition that impacts society, and every sector of the economy, and involves every single company and every single member of the public. Technology is developing at an ever-increasing pace. This creates opportunities for new products, services and income models. Digitalisation can provide innovative solutions to society's challenges and help to improve labour productivity. This transition is happening in a playing field of worldwide competition. At the same time, people are becoming more aware of the need for responsible, humane application of the technologies and strategic autonomy is also becoming more important.

THE OPPORTUNITIES AND THREATS THAT DIGITALISATION POSES REQUIRE STRONG RESPONSE.

Digitalisation is one of the three key transitions identified by the Rutte IV Cabinet. The European Commission sees the digital transformation as an essential requirement and a priority for the competitive position of the EU's Member States and for modernising their economies. As highlighted by recent investments that the National Growth Fund (NGF) has made in Artificial Intelligence and Future Network Services (conditional), the Netherlands is aware, in terms of capital expenditure, of how important digital and information technologies are for the country's earning capacity. The Netherlands is in a strong starting position. The most recent European Digital Economy and Society Index (DESI) places the country in the Top 5 in each of the dimensions of human capital, connectivity, integration of digital technology and digital public services. [1] The size of the ICT sector contributes to a substantial portion of the country's earning capacity. In 2023, the proportion of the entire Dutch economy that the ICT sector contributes is estimated at 4.4% of the GDP. [2] The various sectors of the Dutch economy employ around 556 thousand ICT professionals.

To retain this position, boost the Dutch economy and use digitalisation to further utilise opportunities for innovation, we will need to continue with research and innovation in the field of digitalisation and digital and information technologies. Innovation policy in the Netherlands is based on the Mission-Driven Top Sectors and Innovation Policy (*Missiegedreven Topsectoren- en Innovatiebeleid*, MTIB). The MTIB was introduced in 2019 and refined by drawing on the Top Sectors policy. The ten Top Sectors are the areas where the Netherlands can be considered to be leading the way internationally.[3] The Top Sector organisations operate as public-private partnerships that bring together the business community, scientists and academics, government organisations and social organisations. The MTIB is part of the Dutch industrial policy. Policies relating to digital innovation also fall within the scope of the Cabinet's Digital Economy strategy.

Table 1 – The seven digital and information technologies.

DIT – DIGITAL AND INFORMATION TECHNOLOGIES

1 ARTIFICIAL INTELLIGENCE (AI)	Artificial intelligence (AI) is a system technology aimed at realising behaviour in machines that resembles natural intelligence.
2 DATA SCIENCE, DATA ANALYTICS AND DATA SPACES	Data science, analytics and data spaces (data ecosystems) covers every aspect of gathering, managing, accessing, sharing and analysing data for the purpose of creating value.
3 CYBER SECURITY TECHNOLOGIES	Cyber security technologies are intended to reduce relevant digital risks to an acceptable level. This also covers handling risks of damage to or loss of digital systems and data availability, integrity and confidentiality.
4 SOFTWARE TECHNOLOGIES AND COMPUTING	Software technologies and computing is about developing methods and techniques for software to make it usable and reliable and capable of being maintained on a permanent basis.
5 DIGITAL CONNECTIVITY TECHNOLOGIES	Digital connectivity technologies will create a new generation of wired and wireless networks that are capable of meeting the rising demand for capacity, are robust and flexible and are efficient in terms of energy and materials used.
6 DIGITAL TWINNING AND IMMERSIVE TECHNOLOGIES	Digital Twinning and Immersive technologies are a digital representation of physical processes and systems for digital and autonomous production, analysis and optimisation.
7 NEUROMORPHIC TECHNOLOGIES	Neuromorphic technologies are about bio-inspired hardware for energy-efficient information processing.

Source: Van Bree et al. (2023). Herijking Sleuteltechnologieën 2022. TNO and NWO, March 2023.

[1] *European Commission (2022). Digital Economy and Society Index (DESI) 2022. Thematic Chapters. https://ec.europa.eu/newsroom/dae/redirection/document/88764.*

[2] *Statistics Netherlands (2022). ICT, kennis en economie 2022. Updated using provisional data from Q3 2023 for the ICT sector in CBS Statline (companies; sector of the economy, with the ICT sector defined according to: https://www.cbs.nl/nl-nl/nieuws/2020/42/ict-sector-groeit-harder-dan-de-economie/ict-sector).*

[3] *The ten Top Sectors are: Agri & Food; Chemistry NL; Creative Industry; Energy; Health Holland (Life sciences & health); Logistics; Holland High Tech (High Tech Systems & Materials); Horticulture & Starting Materials; Water & Maritime; and ICT.*

1.2 DIGITALISATION AND DITs

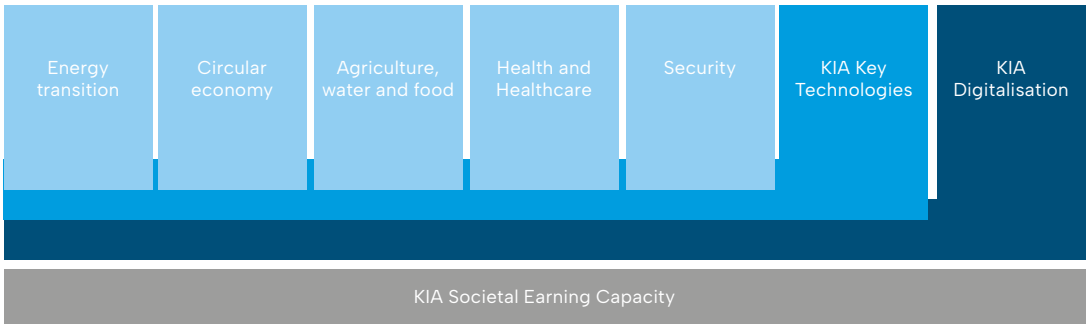
Digitalisation is a transitional process that is impossible to achieve without developing new digital and information technologies. Digitalisation involves using highly innovative existing and emerging digital and information technologies. Digital technologies cover a wide range of possibilities. For the purposes of this Agenda, they comprise a set of key enabling technologies known as the Digital and Information Technologies (DITs) cluster, which will open up possibilities for all manner of applications. These DITs include seven key enabling technologies, which together belong to a larger group of 44 key enabling technologies under the National Technology Strategy (NTS) that is being developed. The seven DITs are listed and explained in Table 1. [4] (See page 7).

Simply developing and applying technologies is not enough, however. Transition is a social process, one that requires a multidisciplinary and plotting approach that considers social, ethical and legal aspects.

1.3 DIGITALISATION AND MISSIONS

The MTIB links the innovative capabilities of the Top Sector organisations to tackling social challenges, known as 'missions'. When the MITB was first introduced, 25 missions were presented. The areas of focus were: *'Energy transition and sustainability', 'Agriculture, water and food', 'Health and care'* and *'Security'*. In 2023, the missions have been recalibrated with the goal of tackling the major challenges currently facing the Netherlands. The **five central missions** are: Energy Transition; Circular Economy; Health & Healthcare; Agriculture, Water & Food; and Security. The missions are the basis for five mission-driven **Knowledge and Innovation Agenda** (KIAs). Running across these mission-driven KIAs are three further KIAs: the KIA Key Technologies (KT), the KIA Society's Earning Capacity (SEC) and the KIA Digitalisation.
Most of the mission-driven KIAs use Long-Term Mission-Driven Innovation Programmes (Meerjarige Missiegedreven Innovatieprogramma's, MMIPs) that describe specific actions aimed at achieving the objectives. The MMIPs identify in explicit terms what knowledge and innovation activities are needed for each of the separate elements of the chain innovation for research, development, pilots/demonstration and implementation.

Figure 1 – Missions of the MTIB and the position of key technologies, digitalisation and society's earning capacity within those missions. Source: KIA KT.



[4] *For further details, see Annex A: Full descriptions of the seven digital and information technologies.*

1.4 KNOWLEDGE AND INNOVATION AGENDA DIGITALISATION

The Knowledge and Innovation Agenda Digitalisation is a new feature of the MTIB. This KIA deals with digitalisation as a transition and with the key digital technologies. As such, it is related to the KIA Key Technologies (KIA KT). Both these KIAs are cross-sectional: they interface with each of the missions (and their specific KIAs) and are connected to each of the Top Sectors.

The KIA Digitalisation serves to complement the KIA KT, and together they form a single unit that is concerned with both key enabling technologies and digitalisation. However, where the KIA KT focuses primarily on innovation **in** key enabling technologies with a view to their further development, the KIA Digitalisation is also aimed at innovation **with** the seven specific key digital technologies for the benefit of the missions. The KIA Digitalisation is also concerned with digital transformation as a catalyst for the further development of the various missions and the earning capacity of the economy and society of the Netherlands. A vital aspect of this is reflection **on** digitalisation and key digital technologies. This centres around frameworks for a responsible, safe and sustainable digital transition and for responsible and broadly supported innovation in key digital technologies, and their application, without losing sight of public values. This also overlaps with the Value-Driven Digitalisation Agenda of the Dutch Ministry of Foreign Affairs and Kingdom Relations (*Binnenlandse Zaken en Koninkrijksrelaties*, BZK).

The present KIA describes how and along what themes knowledge institutes, companies and government organisations plan to work together on digitalisation and key digital technologies during the 2024-2027 period. This description provides a brief outline only. **The KIA Digitalisation serves as a strategic framework for further programming between the parties involved**, as part of the new Knowledge and Innovation Covenant (KIC) 2024-2027. That follow-up process of programming will include detailing concrete knowledge questions and programmes, for which available subsidy instruments and budgets can be used once they have been allocated to the KIA Digitalisation.

This KIA was drawn up by a broad selection of stakeholders in the summer of 2023, with Topsector ICT playing a coordinating role. It presents a snapshot based on interviews with various different knowledge and innovation partners: persons who are involved in the missions, other KIAs and innovation partners in digitalisation within the sector, such as coalitions and sector organisations, the scientific and academic community and government organisations.

A NEW KIA, BUT ONE WITH A HISTORY

A new Knowledge and Innovation Agenda for Digitalisation highlights the growing importance of digitalisation for the Netherlands. Although this KIA is new, it has not sprung from nowhere. Recent decades have seen a series of public-private programmes and coalitions dealing with digitalisation and digital technologies. First the ICT Roadmap for Top Sectors (2012) and later Topsector ICT (2014 and beyond) encouraged the parties to form coalitions. This resulted in a series of partnerships and programmes that the KIA Digitalisation can now build on, for example Commit2Data, dcypher, the Dutch Blockchain Coalition (DBC), the Netherlands AI Coalition (NL AIC) and the CS4NL consortium. These efforts also build on large programmes from before, for example the BSIK programmes MultiMedian, Freeband and BRICKS, and the FES programme COMMIT. More recent examples that have been awarded include the NGF programmes AiNed and FNS (conditionally), as well as for instance NWO's LTP programme ROBUST (AI).

1.5 MISSION AND VISION

The digital transformation affects every single sector, and has a tremendous impact on the earning capacity of the Netherlands. This transformation will be impossible without developing new digital and information technologies. At the same time, it is also a social process, one which requires a multidisciplinary approach that also addresses the ethical, legal and social aspects of the digital transformation.
The KIA Digitalisation brings together knowledge institutes, companies, government organisations and members of the public ('quadruple helix') to promote digitalisation for all the various missions and Top Sectors of the MTIB. Specifically, they work together on knowledge development and innovation relating to the digital transformation, making responsible use of the seven digital and information technologies (DITs) (as defined in the list of key enabling technologies) without losing sight of public values.

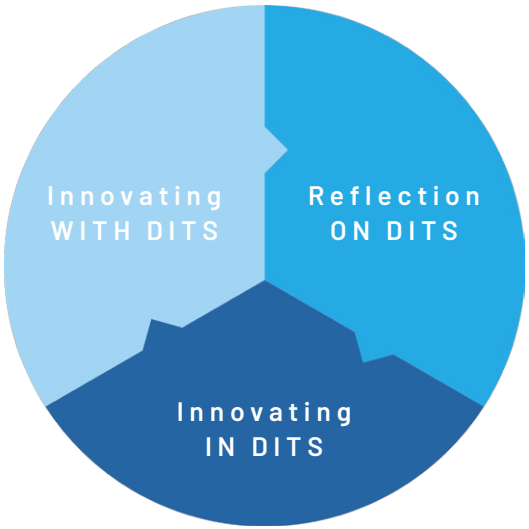
The KIA Digitalisation offers a structure that runs across missions and sectors to promote comprehensive knowledge development and innovation in DITs and digitalisation. The KIA Digitalisation offers this structure in the form of:

INNOVATION WITH DITs
Researching and making innovative use of the seven key digital technologies for the MTIB's missions in partnership with the theme-based KIAs.

REFLECTION ON DITs
Ensuring a responsible digital transformation and responsible development and application of the seven key digital technologies.

INNOVATION IN DITs
Further developing the seven key digital technologies in partnership with the KIA Key Technologies.

Figure 2 – Three pillars of the KIA Digitalisation.



THESE THREE PILLARS ARE SEPARATE PARTS OF A WHOLE, INTERLINKING AND REINFORCING EACH OTHER (SEE FIGURE 2):

- Innovation **WITH** and Innovation **IN** provide the relevant context for Reflection **ON**.
- Reflection **ON** provides practical parameters for Innovation **IN** and Innovation **WITH**.
- Innovation **IN** provides generic solutions that can be applied through Innovation **WITH**.
- Innovation **WITH** provides new ideas and challenges for Innovation **IN**.

1.6 AMBITIONS AND OBJECTIVES

The KIA Digitalisation contributes directly to the ambitions of the strategy for the Digital Economy and the Value-Driven Digitalisation working agenda. This also helps to improve the position of the Netherlands on the DESI.

PUBLIC-PRIVATE PARTNERSHIPS UNDER THE KIA DIGITALISATION DO THE FOLLOWING:

- They drive and programme innovation to make a lasting contribution to solutions for the missions facing the Netherlands and helping to improve the country's earning capacity.
- They reflect on the relationship between DITs and society by considering ethical, legal and social aspects as well as issues such as sustainability, safety and sovereignty.
- They offer a strategic framework for public-private investment in innovation (specifically digital-led innovation) that aligns with national and European policy programmes and strategies.
- They encourage and facilitate the formation of long-term coalitions to respond to existing and evolving social challenges and economic opportunities.
- They provide the government with input on developments in digitalisation and the opportunities that it presents for policies and instruments.

THE KIA DIGITALISATION'S COLLECTIVE AMBITIONS FOR THE 2024-2027 PERIOD ARE:

- To set up **at least five demand-driven programmes with the mission KIAs** from the pillar of Innovation WITH DITs. Each of these programmes should address urgent requirements for one of the MTIB's missions.
- To set up **two cross-sectional, demand-driven programmes for DITs** with relevance for multiple missions from the pillar of Innovation IN DITs.
- **Each of these programmes should also be concerned with parameters and design principles** from in the pillar of Reflection ON DITs.

Realisation of these ambitions will depend on stakeholder participation – in framing, interests, commitment and financing – and availability of appropriate resources.

CHAPTER 2

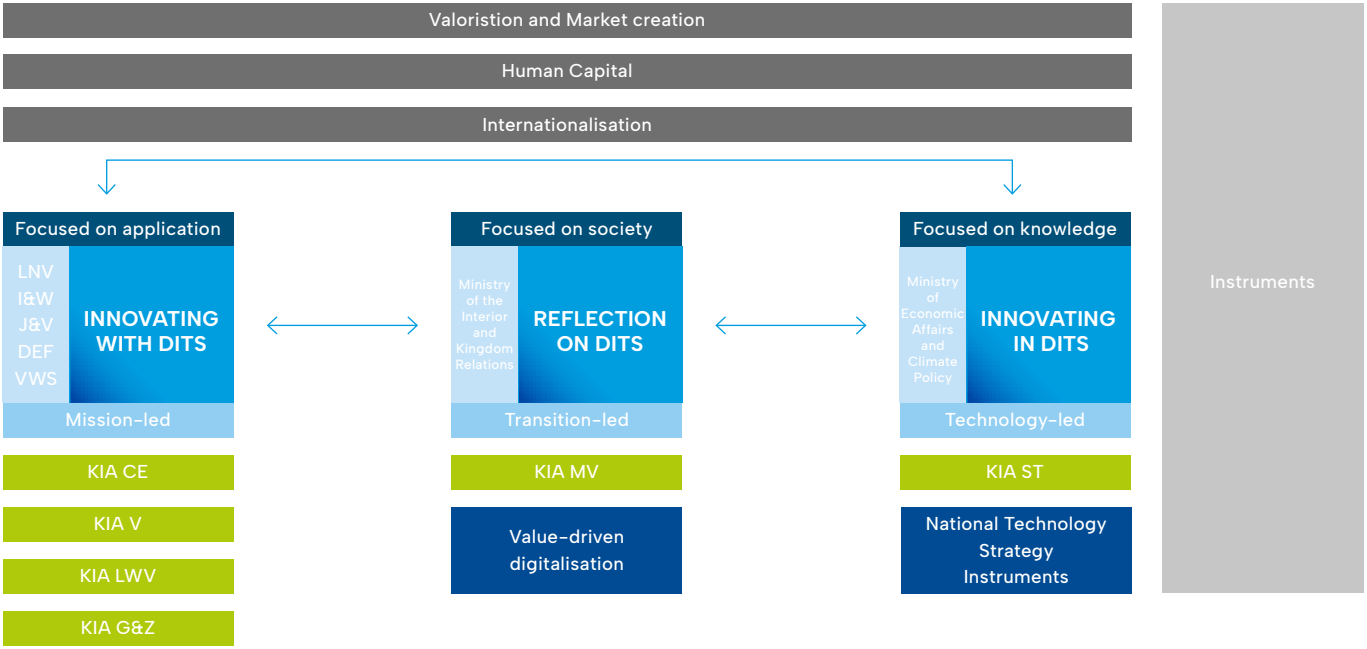
FRAMEWORK, SETTING AND POSITIONING

Figure 3 shows the three components of this KIA that were described above. The pillar of Reflection ON is shown cutting across the two other pillars. That means that this pillar provides parameters and frameworks for the other pillars to relate to. Also shown is what drives the substance of these pillars. For Innovation WITH, the drivers are the various MITB missions (and the associated KIAs), while Innovation IN is driven by development of the key enabling technologies "digital and information technologies" (DITs).

For the pillar of Reflection ON, the driver is the broader digitalisation transition, since this pillar is concerned mostly with society's wider adoption of digital technology.

Figure 3 also shows the elements of market creation, human capital and internationalisation, which are part of this KIA. A variety of subsidy instruments can then be used for the separate pillars and elements (see section 3.3).

Figure 3 – Structure of the KIA Digitalisation.



The structure of this chapter is based on the separate pillars shown in Figure 3. Section 2.2 describes the substance of the pillars that provide the framework for programming the KIA Digitalisation. Sections 2.3 to 2.5 then describe the elements of valorisation and market creation, internationalisation and human capital. The instruments that are available and should be used are explained in the chapter discussing implementation (Ch. 3).

2.1 RELATIONSHIP TO POLICY

In terms of policy, the importance of digitalisation is enshrined in the various agendas such as the Digital Economy strategy of the Ministry of Economic Affairs and Climate Policy (Economische Zaken en Klimaat, EZK), which is concerned with creating a strong, enterprising, innovative and sustainable digital economy. EZK is also working on a National Technology Strategy (NTS), which is expected to be published in late-2023, and which will focus the government's efforts on key enabling technologies that align with the country's strengths, that are relevant to its earning capacity and national autonomy and security (economic and otherwise), and their potential for solving social challenges. The KIA KT will use the priorities defined in the NTS as its strategic framework for programming during the 2024-2027 period.

The pillar of Innovation IN in the KIA Digitalisation complements the KIA KT (see section 2.2.3). This pillar links directly to the key enabling technologies described in the list of key technologies that are central to the KIA KT. The list of 44 key technologies includes seven digital and information technologies (DITs) that play a central role in using digitalisation to tackle social challenges.
This is paralleled by the Value-Driven Digitalisation working agenda developed by BZK, which outlines the parameters for a functioning digital society, with a focus on public values that are vital to a successful digital transformation. That working agenda provides relevant frameworks for the activities that are covered by the pillar of Reflection ON in this KIA.

Another important policy development is the Cabinet's approach to Digital Open Strategic Autonomy (DOSA), developed by EZK. EZK hopes that this effort to further shape open strategic autonomy for the digital domain will serve as an agenda at both the national and the European level, by creating urgency for the issue and announcing or advocating actions. To this end, policy priorities are selected where EZK wishes to make a greater effort, for example AI, cloud technology and cybersecurity. DOSA will provide a framework for the various elements of this KIA and so create synergy between the two initiatives.

2.2 FRAMEWORK FOR PROGRAMMING KNOWLEDGE AND INNOVATION

▸ 2.2.1 *Innovation WITH DITs*

Within this pillar, the emphasis is on working together with the mission KIAs on matters of digitalisation and digital technologies. The programming for this pillar will align with the missions' needs, to develop DITs to realise those missions.

This approach requires strong interaction with the mission KIAs. The mission KIAs in turn will maintain close connections with the relevant theme-based policy directorates to make sure that the efforts under these agendas align with the appropriate policy objectives. This includes endeavouring to use digitalisation and the DITs as catalysts

to accelerate and amplify the efforts towards these missions, and so improve the country's capability for innovation and competition. In the lead-up to this KIA, during the development of the NTS, RVO explored the areas where the DITs meet the separate missions. Tabel 2 shows those interfaces, plus other interfaces that were identified during the preparations for this KIA. Based on this information, several possibilities have been identified to decide on programming that is shared with the aspect of Innovation WITH. The sections below describe options for each mission for how to further operationalise those interfaces.

Table 2 – Relevant DITs for the separate mission KIAs.

DITs	HEALTH & HEALTHCARE	AGRICULTURE, WATER & FOOD	SECURITY	ENERGY	CIRCULARITY
ARTIFICIAL INTELLIGENCE (AI)	✓	✓	✓	✓	✓
DATA SCIENCE, DATA ANALYTICS AND DATA SPACES	✓	✓	✓	✓	✓
CYBER SECURITY TECHNOLOGIES	✓	✓	✓	✓	✓
SOFTWARE TECHNOLOGIES AND COMPUTING	✓	✓	✓	✓	✓
DIGITAL CONNECTIVITY TECHNOLOGIES	✓	✓	✓	✓	
DIGITAL TWINNING AND IMMERSIVE TECHNOLOGIES	✓	✓	✓	✓	✓
NEUROMORPHIC TECHNOLOGIES		✓			✓

Source: RVO's analysis for the NTS, with additional stakeholder consultations carried out during the preparations for this KIA.

2.2.1.1 Mission: Health & Healthcare

The central mission for Health & Healthcare is, "By 2040, people in the Netherlands should be living in good health for 5 more years, with 30% less health difference between distinct social and economic groups." [5] If digitalisation is developed and applied properly, it can help to achieve this mission by playing a supporting role in the form of *digital health technologies*. Under this label, several DITs might contribute to how health and healthcare can be improved, how the various actors can utilise data (subject to strict conditions), how new interventions can be developed or what can be added to or substitute for existing health and healthcare interventions.

Within the theme of Health & Healthcare, the various practical contexts carry specific importance. The theme generally devotes particular attention to testing innovations in the relevant contexts, from home, work and school settings up to and including of course healthcare in practice. Tests involving patients and their informal caregivers up to and including health-care professionals will be needed for these innovations to reach the point where they are funded as a matter of course and are in fact used by them. Digitalisation can also help to boost labour productivity, cut costs of labour and reduce worker shortages. Knowledge and innovation within this theme should contribute, directly or indirectly, to the policy set out in the healthcare agreements recently signed by the Ministry of Health, Welfare and Sport (*Volksgezondheid, Welzijn en Sport*, VWS) with numerous stakeholders and partners, although this presents a whole series of challenges in terms of adoption, implementation, funding, etc. that go beyond the scope of the MTIB. By way of the KIA H&HC, the KIA Digitalisation is linked

to relevant frameworks of EZK and VWS at the interface between public-private partnerships on the one hand and digitalisation and health & healthcare on the other.

EXAMPLES OF TOPICS THAT CONTAIN POSSIBILITIES FOR SHARED PROGRAMMING FOR THE THEME OF HEALTH & HEALTHCARE ARE:

• **Systems for securely connecting, storing and utilising health & healthcare data** are concerned with creating/further developing a robust infrastructure and a state-of-the-art appointment set-up (e.g. FAIR and PHT) to manage health & healthcare data. Interoperability is a key component for making sure that different systems can communicate and for interfacing with sources. At the same time, it is important to take care with legal and privacy aspects in order to ensure the security and confidentiality of health data. This will help towards data democratisation and make faster innovation in health & healthcare possible. This also contains a close link to the pillar of Reflection ON. Knowledge and innovation in this area align with the National Vision and Strategy of VWS, the European Health Data Space, the European AI Act and the European Critical Entities Resilience (CER) Directive for digital defences in the health & healthcare system.

One example of a programme that was recently developed in this field is the **NGF programme Health RI**, which is concerned with establishing an integrated infrastructure for health & healthcare data to provide secure access, under strict conditions and for repeated use, to members of the public, researchers, caregivers and companies. Health RI is operated in partnership with other data platforms and initiatives such as CumuluZ and Population Health Data.

• **Useful and secure AI for prevention, diagnostics, research and development:** AI can be applied for health & healthcare in countless innovative ways. For instance, learning algorithms can be used to recognise patterns in imaging techniques for example, to help with diagnostics. AI can also be used to accelerate research and development of medicines, for example by predicting what chemical structures might be effective in medicines, and so making the development process much more selective. AI can furthermore be used for recognising patterns in health data and environment data that can reveal determinants for health and sickness and help with prevention and intervention. For matters of AI, VWS and EZK are already working together in the NL AIC, with the policy of 'conditions for and encouragement of appropriate use of value-driven AI in health & healthcare'.

• **Digital health technologies and avatars for use in health & healthcare** are concerned with using digital technologies, for example e-health, to improve the availability of prevention and care, simply interaction and align closer with health & healthcare needs. Digitalisation can also help to simplify how patients and/or their informal carers interact with formal caregivers and how caregivers interact with each other, to overcome language barriers and to improve labour productivity and cut labour costs. Immersive technologies and AI can help to simplify interactions, for example by introducing lifecycle-proof avatars for health & healthcare that provide a universal interface for the numerous e-health applications and digital systems for health & healthcare. Digital health technologies should not only complement, but also become an integral part of, health advocacy and healthcare (appropriate hybrid prevention and care). This means that they should be part of the process of transforming health & healthcare concepts in order to contribute towards achieving the agreements and missions for health & healthcare.

[5] *Letter to the House of Representatives: Herijkte missies van het missiegedreven innovatiebeleid ("Recalibrated missions for mission-led innovation policy"), Parliamentary Records 120, 30 May 2023.*

2.2.1.2 Mission: Agriculture, Water & Food

The Agriculture, Water & Food (AWF) mission is concerned with creating vital rural areas, resilient nature, sustainable agricultural and food systems and a safe delta in a climate-proof country. Digitalisation is a crucial component in achieving these goals. The KIA AWF includes activities involving sensors, precision fertilisation, data exchanges, satellite technology and data management for monitoring, transparency and security in the agricultural and food supply chains.

The KIA AWF covers six missions and separate key technology programmes. Digitalisation plays an important role in these missions, emphasising monitoring, data analysis, decentralised technology and AI. It is also vital to work together with other key technologies such as Engineering & Fabrication Technologies and Life Science Technologies. The KIA Digitalisation is working closely with the KIA AWF and relevant TKIs to develop knowledge and applications for a climate-neutral, circular and nature-inclusive country that reflects the Digitalisation Vision for sustainable agriculture, food supply chain and nature.

EXAMPLES OF TOPICS THAT PRESENT OPPORTUNITIES FOR SHARED PROGRAMMING IN AGRICULTURE, WATER & FOOD INCLUDE:

- **Data access and monitoring:** ean important aspect of digitalisation in the agriculture, water & food sector is gathering high-quality data. This involves not only gathering high-quality data, but also safeguarding data quality, improving access to data, the coverage of data sets and monitoring data. Examples include gathering biodiversity data, better mapping out soil data and monitoring water quality and natural ecosystems. Being able to access and process accurate data (including monitoring data) helps to improve the sector's decision-making.
- **Modelling and predicting:** digitalisation offers possibilities for processing and analysing large volumes of data. This involves facilitating data exchanges, sharing data and developing advanced data processing methods, such as improving interoperability, data architecture and developing data spaces for the horticultural sector, for instance. Creating digital twins for bio-based flows – managing residual streams to reduce food waste and energy production can play an important role in improving the agricultural and food supply chains.
- **Use of AI:** AI plays a key role in several aspects within this sector. Applications include improving crops, improving crop protections, bio-informatics for genetic analyses and water safety. As a result, AI solutions contribute to a more efficient use of raw materials, less burden on the environment and higher quality of food production.
- **Decentralised technologies for food supply chains:** decentralised technologies such as blockchain can be used to make the food supply chain more transparent, better traceable and more efficient. They are also vital for making agrifood more sustainable and improving the position of farmers and horticultural producers.

2.2.1.3 Mission: Security

The Security mission is aimed at ensuring the safety and defences of the Netherlands, against both external threats and subversive crime, through a focus on using digital data. Digitalisation plays a central role for the KIA Security, for example in tackling organised crime, modernising the armed forces and ensuring cybersecurity. Digitalisation is also used to instruct and train security professionals. Accordingly, the KIA Digitalisation is concerned with developing knowledge and applications for DITs to make sure that the Netherlands can remain one step ahead of its adversaries (actual and potential) by using smart solutions to help create a safe society. This is done in partnership with the KIA Security and the relevant TKIs (TKI HTSM, TKI

Maritime, TKI Logistics). The efforts draw on the Strategic Knowledge and Innovation Agenda (SKIA) 2021–2025 of the Ministry of Defence, [6] the Defence Industry Strategy [7] and the Dutch Cybersecurity Strategy. [8] It is also important to be aware of developments in elsewhere in Europe.

EXAMPLES OF ISSUES THAT PRESENT OPPORTUNITIES FOR SHARED PROGRAMMING IN THE FIELD OF SECURITY INCLUDE:

- **AI in/for the security domain:** AI offers opportunities for improvement within the domain of security, for example using AI for autonomous and unmanned systems. AI can also be used to support decision-making in security scenarios, where analysing large volumes of data can help in identifying threats and taking proactive measures.

- **Digital twinning for situational awareness and intervention planning:** digital twins offer the possibility of providing accurate situational awareness and planning interventions in complicated and rapidly changing settings. This can help with optimising response and crisis management measures.

- **Cybersecurity for secure supply chains and the safety of the Netherlands:** opportunities can be identified for improving the cybersecurity of supply chains in the Netherlands, to guarantee the integrity of goods and information. Cybersecurity in a broader sense is also vital to national security overall. As cyber attacks become more and more advanced and more and more of a threat, innovative cybersecurity solutions need to be developed.

- **Digitalisation in the security domain:** using digitalisation in the security domain can make security workers more efficient and more effective. This involves automating processes and using advanced technologies to support workers with their tasks. It also ties in closely with social innovation, which explores new ways of working and interacting to create a safer society.

2.2.1.4 Mission: Climate & Energy

The mission for energy is, "Make the Netherlands climate-neutral by 2050". [9] Digitalisation presents both opportunities and challenges for the energy transition, in a wide range of areas, including the built-up environment. On the one hand, digitalisation can help with optimising processes, making more efficient use of energy and ensuring smarter management of the country's energy grid. On the other hand, it can also result in a larger ecological footprint as it requires more energy and materials to use.

The KIA Digitalisation uses knowledge and innovative application in the field of digitalisation and DITs to help make the Netherlands climate-neutral. The KIA Digitalisation does this in partnership with the KIA Climate & Energy and the relevant TKIs (TKI Offshore Energy, TKI Urban Energy, TKI New Gas, TKI Energy and Industry). This follows the Digitalisation Agenda of Topsector Energie (the Energy Top Sector organisation) and helps to realise the Climate Plan, the National Circular Economy Programme and the National Energy System Plan.

6 *Dutch Ministry of Defence (2020). Strategic Knowledge and Innovation Agenda. December 2020.*

7 *Dutch Ministry of Defence (2018). Defence Industry Strategy. November 2018.*

8 *NCTV (2022). Dutch Cybersecurity Strategy 2022-2028. October 2022.*

9 *Letter to the House of Representatives: Herijkte missies van het missiegedreven innovatiebeleid ("Recalibrated missions for mission-led innovation policy"), Parliamentary Records 120, 30 May 2023.*

EXAMPLES OF TOPICS THAT PRESENT OPPORTUNITIES FOR SHARES PROGRAMMING IN THE FIELD OF CLIMATE AND ENERGY INCLUDE:

- **Sustainable digitalisation:** developing low-energy hardware, architectures and software is a vital step towards reducing the ecological footprint of digitalisation. Innovation using software technology and computing and digital connectivity technologies is important for developing more efficient and more sustainable digital solutions.

- **Digitalisation of the energy system:** optimising the country's energy grids is vital for preventing congestion and creating a dynamic energy system. Digitalisation plays a major part in this by developing reliable, cybersecure and fast digital systems such as sensors, data transfer, data processing and automatic decision-making (this also involves AI, data science, data analytics and data spaces, cybersecurity technologies and digital connectivity technologies). Digital twins can help in researching and testing these digital networks of the future.

- **Sharing and using data:** data from sources such as smart meters, electric vehicles (and chargers), heat pumps and solar panels can all be collected and used, by both consumers and manufacturers. This could result in new business models, new ways of using energy, but also unacceptable use by companies to bolster their market position. This is linked to reflection on DITs and ethical use of data.

- **Tokenisation for the energy system:** wherever possible, refining use cases for digital value transfers of energy tokens for energy communities, smart grids, sustainable supply chains, emissions trading and climate financing, and green mobility. Creating a tokenised carbon credit system that is open to households that have solar panels. Developing an infrastructure to support the use of these energy tokens that interfaces with the existing energy infrastructure.

2.2.1.5 Mission: Circular economy

The circular economy mission is, "The Netherlands should be entirely circular by 2050." [10] Digitalisation offers opportunities for optimising processes, predicting maintenance and tracking materials for reuse. The TKI Construction and Engineering also plays an important role here, with its mission to create a liveable, clean and future-proof built environment by 2050.

The KIA Digitalisation uses knowledge and innovation in the field of digitalisation and DITs to help make the Dutch economy more circular, working in partnership with the KIA Circular Economy and relevant TKIs, including the TKI Construction and Engineering. These efforts tie in with initiatives such as the National Circular Economy Programme.

EXAMPLES OF ISSUES THAT PRESENT OPPORTUNITIES FOR SHARED PROGRAMMING IN THE FIELD OF THE CIRCULAR ECONOMY INCLUDE:

- **Circular designs for digital technologies:** digital hardware sometimes has a short useful life, as new products are developed at a rapid pace. Those products should be designed according to circular principles and be easy to recycle.

- **Maintenance and monitoring:** Digital and information technologies can be used for carrying out smart predictive maintenance that will extend useful lives. Advanced analysis and prediction models that are based on AI or digital twinning can also be employed for making more efficient use of raw materials and optimising production processes. Another possibility is to use extended reality to improve interaction and communication.

- **DITs for encouraging reuse:** Digital technologies such as digital product passports can be used to trace materials all

along the value chain and encourage reuse. That can help in tracing the origins of recycled materials and guaranteeing their authenticity. This will also lead to greater transparency of and confidence in supply chains.

2.2.2 Reflection ON DITs and digitalisation

The cross-sectional pillar of Reflection ON provides parameters and design principles for the pillars of Innovation IN and Innovation WITH. Its purpose is to make sure that digitalisation is given shape responsibly and integrally and that it makes use of new market opportunities. Using the pillar of Reflection ON, specific conditions for adoption of the innovations are already made explicit while the innovation process is going on. Those conditions should help with scaling up, generating market creation and valorisation, creating new income models and new skills and increasing confidence among companies and members of the public.

Among other purposes, this pillar safeguards the ethical, legal and societal aspects (ELSA) of digitalisation, but also other aspects such as sustainability, security and strategic autonomy. This pillar furthermore ensures a focus on design principles such as 'safety by design', 'security by design', and FAIR data. The implications of the forthcoming parcel of digitalisation laws will also be taken into account (see for example the boxed text at 2.4), with their focus on matters such as including responsible AI, confidence among companies and members of the public (using decentralised technologies), interoperability, data portability, cybersecurity, transparency, data quality and control over data and digital identification.

Through Reflection ON, the KIA Digitalisation also links to the working agenda Value-Driven Digitalisation as part of the Digitalisation Agenda of BZK. This revolves around several values for digitalisation: inclusion (no-one should be left behind); security (everyone should be able to trust the digital world); clarity, transparency and autonomy (everyone should have control of their own digital life and the digital government should be driven by values and be open to everyone); and quality and accessibility (strengthening the digital society). Developments in relevant national and European policy will also be monitored closely, for example the European AI and data laws that were developed recently, but also broader developments surrounding matters such as digital platforms, digital services, data sharing and digital sovereignty. Aligning with these developments will be important for making sure that the Netherlands remains at the forefront of responsible digitalisation.

THE ACTIVITIES OF THE KIA DIGITALISATION FOR GIVING SHAPE TO REFLECTION ON WILL BE LAID OUT ALONG THREE LINES:

- **Project proposals will ask to address Reflection ON:** The KIA Digitalisation requires that proposals explain – wherever possible – why the project does or does not address parameters and design principles from the pillar of Reflection ON, and how. The KIA Digitalisation wants this element to become part of a selection criterion. This way, the relevance and importance of design principles and parameters for the innovation that will be developed are, at a minimum, given some thought beforehand, which will facilitate better adoption further down the road.

[10] *Letter to the House of Representatives: Herijkte missies van het missiegedreven innovatiebeleid ("Recalibrated missions for mission-led innovation policy"), Parliamentary Records 120, 30 May 2023.*

- **Promoting multidisciplinary and quadruple-helix partnerships:** forming broad coalitions with relevant parties will be strongly encouraged to make this more multi-disciplinary approach part of the KIA Digitalisation. This includes involving members of the public and/or end-users (such as involving caregivers in projects relating to health & healthcare). Expertise drawn from the arts and social sciences will be vital for giving shape to digital confidence, value-driven digitalisation and the parameters and design principles that will foster adoption (and therefore market creation) of digital innovations.

- **Raising awareness of the Key Enabling Methodologies toolbox:** The KIA Digitalisation will gladly make room to draw on the various Key Enabling Methodologies (KEMs) of the KIA Society's Earning Capacity (SEC). Where this is relevant, Reflection ON will make use of these KEMs. The KEMs for the category 'Vision & Imagination' will help with mapping out the existing world, imagining new worlds and viewing problems from a new perspective. KEMs for the category 'System Change' offer methods for introducing possibilities for transition into participative processes and methods for guiding and accelerating the preferred transitions. KEMs in this category will also help with understanding and 'guiding' system change through smarter anticipation, smarter reaction and 'learning from action' and 'acting while learning'. KEMs for the category of 'Monitoring & Measurement' help to map out an intervention's results, measure its effects and monitor its impact.

Lastly, this pillar should offer synergies with existing initiatives such as the ELSA labs of AiNed, which Reflection ON can build on. These labs focus on Ethical, Legal and Social Aspects and use the quadruple helix to work on responsible AI applications. Working with such labs offers an opportunity to share knowledge and expertise and work together to promote responsible digitalisation.

2.2.3 Innovation IN DITs

Innovation IN Digital and Information Technologies (DITs) takes place in the seven key enabling technologies shown in Tabel 1. This is concerned with generic technological development for technologies that are strategically, technologically and economically important to the Netherlands. The KIA Digitalisation's programming aligns with the priorities of the National Technology Strategy (NTS) that is currently under development and EZK's DOSA. As such, the KIA Digitalisation follows the same framework of the KIA KT's programming for the other key technologies as well.

The KIA Digitalisation prioritises, initiates and coordinates the programming for the seven DITs, aligning with the KIA KT, which is concerned with all the key technologies. Innovation IN is about developing knowledge of and innovations in DITs with relevance for all missions and with generic applicability. The resulting knowledge and innovation can then (in the longer term) be fine-tuned to match the missions in Innovation WITH. Tabel 2 provides an idea of DITs with relevance for all the missions, meaning that they offer significant opportunities for innovation. These are: AI; data science, data analytics and data spaces; cyber-security technologies, digital twinning and immersive technologies and software technologies and computing. The programming frameworks for Innovation IN cannot be outlined until after the NTS has been published (which is expected to be late-2023).

Innovation IN will also include responsible experimentation and working towards valorising knowledge in Dutch strengths. The KIA Digitalisation furthermore wishes to ensure parameters for innovation in DITs, to make sure that technological developments are undertaken responsibly.

By integrating parameters and methods for reflection on technology at the start of the innovation process, the KIA Digitalisation will ensure that strategic innovations do not lose sight of public values. This can also help the Netherlands to break new ground in Europe. Our role in this respect is an advisory one, acting in some instances through existing coalitions such as dcypher, or the Dutch AI Coalition and growth fund programmes such as AiNed.

Innovation IN will build on these existing coalitions, as well as on other research and innovation programmes such as Commit2Data, CS4NL and 6G Future Network Services.

2.3 VALORISATION AND MARKET CREATION

Valorisation and market creation are two important mechanisms for KIA Digitalisation to help improve the country's earning capacity. For these purposes, valorisation and market creation are defined as follows: [11]

- **Valorisation** is the process of creating value from knowledge, expertise and other intellectual capabilities by making them suitable and/or available for economic and/or social utilisation.

- **Market creation** includes all activities in the innovation ecosystem that contribute to opening up new sales markets for innovations and actually bringing this about.

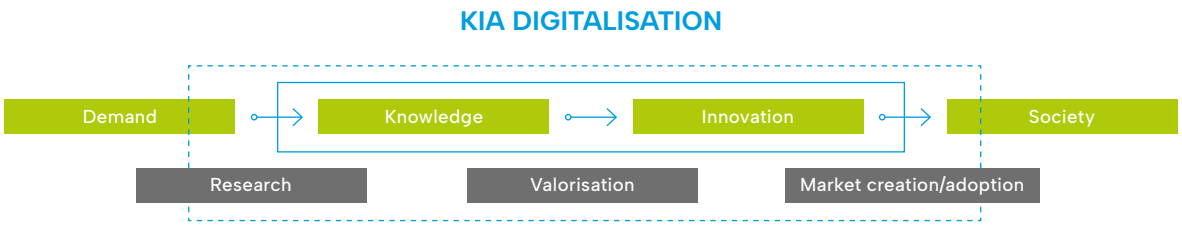
Valorisation and market creation for digitalisation and DITs face particular challenges of their own, as well as challenges that are generic to other domains. Specifically as they relate to digitalisation, valorisation and market creation are often limited by the availability of data or professionals with the right skills. Data availability is one of the parameters for projects of the KIA Digitalisation. Skills are addressed in the Human Capital Agenda ICT.

The KIA Digitalisation is concerned with knowledge and innovation relating to digitalisation and DITs (see Figure 4). In the KIA Digitalisation, knowledge is created from demand-driven/mission-led research. Innovation comes from utilising knowledge to develop new products, services and processes for the missions or for broader generic purposes (platforms).

Valorisation is vital to this. Market creation is vital for introducing innovations into society. **In the context of the KIA Digitalisation, market creation primarily involves adoption of DITs by companies, government organisations, social organisations and members of the public**. Adoption of DITs is a key element in the digital transformation of the country's economy and society. It will open/enlarge new markets for DITs. However, adoption extends beyond the KIA Digitalisation's primary object: the KIA Digitalisation's programming is not aimed specifically at adoption or implementation, but nevertheless embeds parameters in knowledge and innovation programmes to facilitate adoption. The pillar of Reflection ON should supply the appropriate parameters to the pillars of Innovation WITH and Innovation IN to foster adoption, and as such market creation, of future innovations.

[11] *These definitions broadly follow the definitions used in the KIA KT. The KIA KT has taken its definition of valorisation from the 2018 Letter to Parliament on valorisation and social impact (Parliamentary Records 339, 11/12/2018) and bases its definition of market creation on Maria Mazzucato's book The Entrepreneurial State (2013) and other sources.*

Figure 4 – Knowledge and innovation at the heart of the KIA Digitalisation.



No instruments have been developed specifically with valorisation and market creation in mind to overcome the challenges of the domain of digitalisation. The MTIB similarly offers few instruments that can be taken as guidance. The valorisation and market creation efforts of the KIA Digitalisation involve:

- **Making use of existing valorisation instruments:** much is already being done in terms of valorisation. The KIA is working in close cooperation with existing initiatives such as the **Valorisation Delta Plan** growth fund programme, and more specifically the **Digital Technologies Booster**. The KIA Digitalisation makes particular use of the **SME Innovation Stimulus for Top Sectors** (MKB Innovatieregeling Topsectoren, **MIT**) to promote valorisation, pursuing projects under the MIT scheme that align with programmes and projects under the KIA Digitalisation, in order to properly cover the process from knowledge to innovation to society (as per Figure 4) and encouraging progression to further stages of development. It also promotes using instruments such as Take-off (NWO), as happened previously with Commit2Data, and support from **Regional Development Companies** (Regionale Ontwikkelingsmaatschappijen, **ROMs**), TTOs, Invest-NL and Techleap.

- **Focusing on public-private partnerships:** all the programmes and projects under the KIA Digitalisation will be carried out as partnerships between public and private parties, in quadruple-helix relationships: company, knowledge institute, government organisation and member of the public (or: user). This means that under the KIA Digitalisation researchers must always work together with companies and users. This promotes valorisation in the form of knowledge transfer, and where possible in the form of intellectual property. Moreover, working in the context of actual use wherever possible will encourage innovations that align closely with the practical situation, which will facilitate their adoption.

- **Connecting and working with European and regional initiatives:** another important factor for market creation is joining strong European partners in European projects (DEP, EDIC, Horizon Europe) to learn from each other and gain a stronger competitive position. Innovation leaders and technology developers will take part in such research and innovation projects, while among innovation followers adoption should be encouraged. Partnerships will be sought out with Dutch **EDIHs**, which are concerned with using a variety of instruments to promote adoption of digital technologies. The AI Hubs that have been formed in various regions of the Netherlands and that play a key role in connecting and involving local businesses, knowledge institutes and other organisations working in the AI field are also important here.

2.4 INTERNATIONALISATION

Innovation in the Netherlands is not isolated. It takes place within a European and international bilateral context. Like sustainability, digitalisation has been identified as a top priority by the European Commission, in its Shaping Europe's Digital Future Strategy. This is clearly reflected in the volume of laws, regulations and programmes (particularly innovation programmes) scheduled for the years ahead, including the AI Act, which focuses on minimising the risks of using AI, algorithms and machine learning. Other European regulations might also have an impact on the digital transformation, however (see boxed text on the next page).

One important European framework for knowledge and innovation is the Digital Decade Policy programme. For the period until 2030, this will guide Europe's digital transformation, with goals and targets across four themes: skills, digital transformation of businesses, safe and sustainable digital infrastructure and digitalisation of public services. Progress towards the goals will be assessed using various means, including the DESI index. At present, the Netherlands is in third place. To maintain this position, and to scale up to larger levels, it is important to actively seek out connections with European initiatives and research programmes. One of the important initiatives is the European Digital Infrastructure Consortium (EDIC). EDIC is a new European partnership instrument that Member States can use to give legal status to their partnerships involving multiple countries. The European Commission's intention for this instrument is that it will drive Europe's tech sector towards achieving a stronger competitive position worldwide.

For R&D, the framework programme Horizon Europe (specifically the Digital, Industry & Space cluster), the Digital Europe Programme (DEP), Connecting Europe Facility and the Key Digital Technologies Joint Undertaking (KDT JU) are important. Other examples of knowledge and innovation programmes include the Smart Networks and Services Joint Undertaking (SNS JU) and the European Digital Innovation Hubs (EDIHs). Various other initiatives exist, for example the Eureka cluster ITEA4 for software innovation, the AI, Data and Robotics (ADR) partnership and Adra. Topsector ICT is involved in many of these initiatives, either directly or else indirectly through its partners and coalitions. Topics receiving significant European focus at this time include AI, cybersecurity, data spaces, connectivity and digital skills.

The KIA Digitalisation has identified opportunities in Europe. For example, the pillar Innovation WITH presents an opportunity to contribute to various calls under the Horizon Europe and Digital Europe programmes, and the pillar Reflection ON contributes to implementation of new laws and regulations and other European parameters in the Netherlands. The programming makes allowance for European agendas and the international bilateral developments, so as not to be left behind internationally and be able to contribute on a larger scale to the digital transformation.

OVERVIEW OF EUROPEAN DIGITALISATION LEGISLATION IN 2023

- DATA GOVERNANCE ACT (DGA):
  reliable framework for data sharing by government organisations, data intermediaries (trusted role in data sharing transactions), labels for data altruism organisations ('data for good').

- DATA ACT (DA):
  interoperability and portability of cloud services, harmonisation of data sharing initiatives.

- PLATFORM TO BUSINESS REGULATION (P2B):
  transparency requirements for online platforms.

- DIGITAL MARKETS ACT (DMA):
  protecting users of large platforms ('gatekeepers'), better functioning digital markets (market organisation).

- DIGITAL SERVICES ACT (DSA):
  transparency and responsibility requirements for online platforms (with regard to matters such as illegal content, misinformation).

- CYBER RESILIENCE ACT (CRA):
  cybersecurity requirements for digital products (hardware, software) and how they are marketed, continued security updates, transparency about the digital safety of products.

- AI ACT:
  risk-based approach (Regulatory framework proposal on artificial intelligence) that imposes requirements on data quality for AI input, transparency and documentation requirements for high-risk AI, 'human in the loop'.

2.5 HUMAN CAPITAL

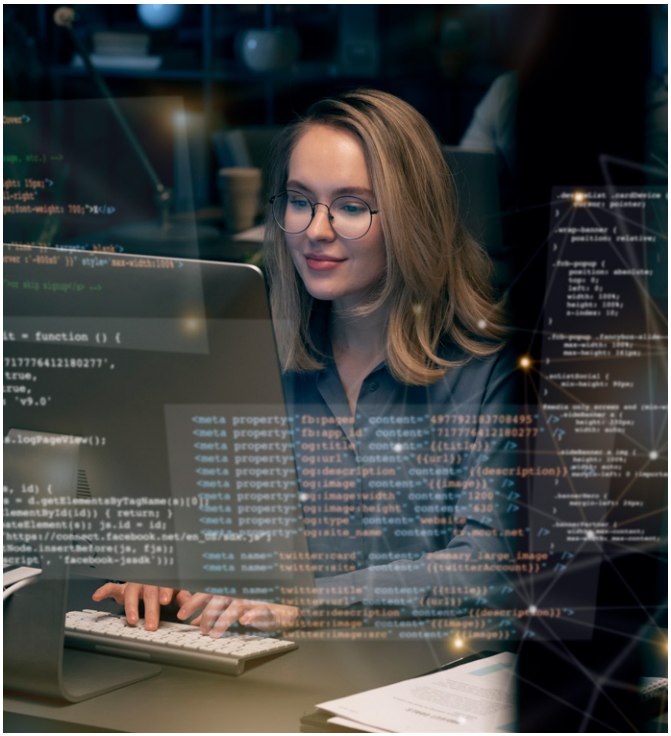
Human capital is one of the parameters for further digitalisation in the Netherlands. This transition can only be made and followed with people who have the right digital skills. Those skills set parameters for researching DITs, reflecting on them and developing them. This makes them vital to the country's capacity for innovating in digitalisation.

Given the structural shortages in every sector of the Dutch labour market, it is important to improve labour productivity. Digitalisation can give every sector a major boost in this respect, which makes it important to the Dutch economy both in the short term and looking further ahead. Shortages on the ICT labour market are causing delays and limitations: the digital solutions necessary for digitalisation need people to build and implement them.

This calls for explicit attention for human capital in digitalisation and DITs in the Netherlands. This makes the Human Capital Agenda ICT (HCA ICT) an important area of attention for Topsector ICT and the KIA Digitalisation. The KIA Digitalisation supports the activities developed under the HCA ICT and connects initiatives. Implementation of the HCA ICT has been assigned to the Platform Talent for Technology as a plan of action.

The HCA ICT will be taken as the basis for addressing challenges relating to human capital in the ICT sector, and beyond as well, considering that more than two thirds of ICT workers are employed outside the sector. The various research and innovation activities of the KIA Digitalisation contribute to the development of new talent, with an examination of possibilities for projects to focus on human capital. The HCA ICT and the Human Capital Coordinator ICT will focus on greater cooperation to ensure mutual reinforcement between the separate human capital components of National Growth Fund applications, with coalitions for key enabling technologies and across multiple Top Sectors. Examples include artificial intelligence (AiNed), digital communication (Future Network Services) and cybersecurity (dcypher). Bringing these together will allow us to achieve more with the existing resources.

In addition, the Cabinet has also designated the HCA ICT as its partner to help give shape to coordinating and directing green and digital jobs. It is also involved in the plan to tackle the chronic shortage of ICT workers. >



THE HUMAN CAPITAL AGENDA ICT

Human capital is an important activity of the Topteam ICT. The Human Capital Agenda ICT (HCA ICT) is a plan of action that is subsidised by EZK. The HCA ICT pursues the goal in the Green and Digital Jobs Action Plan of having 1 million ICT professionals by 2030. At present (2023), around 700,000 ICT workers are employed in the ICT labour market. The projected demand for new and replacement workers will bring the total demand to around 400,000 additional ICT professionals between now and 2030.

To tackle this huge challenge, the Human Capital Agenda ICT is working closely with the regions, national operators, coalitions and the business sector. The focus in the short term is on accelerating the efforts to reskill and upskill people for jobs on the ICT labour market. At the same time, a great deal of effort is going into improving the labour chain approach, starting at primary schools, where pupils are introduced to digitalisation and ICT at an early stage. Later in that chain, digital skills are also integrated into other types of education. Besides generating a larger and more diverse flow of new workers to join the ICT labour market, another important theme is retaining workers and recent graduates (particularly from international backgrounds).

The approach adopted by the Human Capital Agenda ICT is characterised by a regional data-driven approach. In concrete terms, this means that the HCA ICT works with the regions – using regional education and labour market data – to better align education and reskilling programmes to the labour market. To accelerate the pace of building the regional approach to the labour supply chain, the HCA ICT is mapping out successful projects and supporting PPPs to scale up. The National Growth Fund application 'Scaling Up PPPs in professional education' has given these developments an important boost. Based on the Human Capital Agenda ICT, in the autumn of 2023 a National Growth Fund application will be developed that is concerned specifically with training more people for jobs in the ICT labour market.

The HCA ICT also plays an important strategic role in connecting activities and preventing fragmentation at the local, regional and national levels. Key areas of focus are connecting these separate levels and intersectoral partnerships. The Human Capital Agenda ICT is given shape by the Platform Talent for Technology.

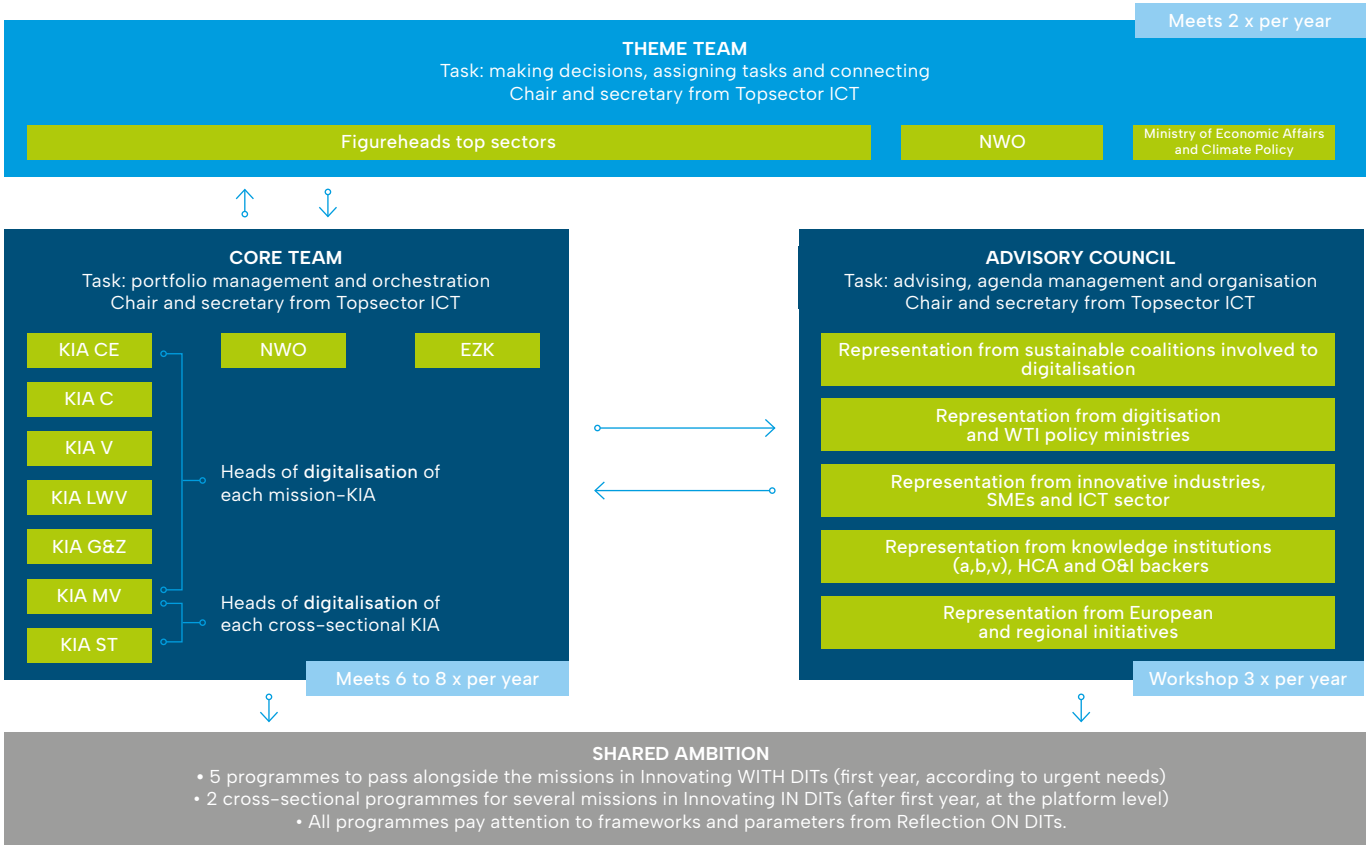
CHAPTER 3

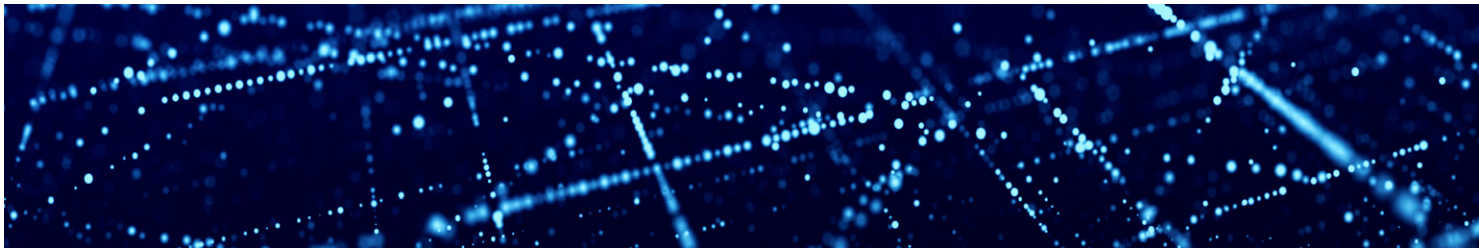
IMPLEMENTATION

3.1 GOVERNANCE

The KIA Digitalisation prefers a simple and efficient governance that is also representative of the cross-sectional and societal qualities of the KIA. This means that the governance enshrines the input on digitalisation from various KIAs and stakeholders in three structures, as shown in Figure 5.

Figure 5 - Governance structure of the KIA Digitalisation.





THE GOVERNANCE OF THE KIA DIGITALISATION IS MADE UP OF:

→ THEME TEAM:

the theme team is the decision-making body of the KIA Digitalisation. This team is chaired by the figurehead of Topsector ICT. The theme team is made up of the figureheads of each of the Top Sector organisations, EZK, the Director of Topsector ICT, NWO (representing academic universities and universities of applied sciences and for the NWO KIC) and TNO (representing the TO2 institutions). The theme team meets two or three times every year (depending on NWO's meeting cycle) based on the agenda and documents prepared by the core team.

→ CORE TEAM:

the core team is the management body of the KIA Digitalisation. This team is chaired by the Director of Topsector ICT. The core team is made up of the TKI directors/motivators from the other KIAs, or else the digitalisation directors of each of the KIAs, and a representative from NWO (representing academic universities and universities of applied sciences and for the NWO KIC), EZK and TNO (representing the TO2 institutions). The core team manages the portfolio of programmes and projects under the KIA Digitalisation, orchestrates partnerships and initiatives and prepares resource commitments. Its methods include gathering advice and ideas from the represented bodies and the advisory council for the KIA Digitalisation. To this end, the core team organises strategic work sessions with the advisory council.

The core team prepares the agenda and decision-making documents that the theme team discusses. The core team has regular meetings every 4-6 weeks, two or three of which each year take the form of work sessions with the advisory council. To reduce the number of meetings that everyone needs to attend, the core team's meetings are set up as an information session attended by all the members and an exploration/detailing session attended only by members who want to be involved in giving shape to the relevant agenda items.

→ ADVISORY COUNCIL:

the advisory council is the body of the KIA Digitalisation that provides advice, and where various public and private stakeholders come together to feed the three pillars. The council meets two or three times per year in work sessions, to advise the KIA Digitalisation's core team, share ideas and developments from the work field and be encouraged to organise partnerships.

THE ADVISORY COUNCIL'S MEETINGS CONSIST OF TWO COMPONENTS:

1 The first component is a closed meeting, where various groups are represented. They are invited by the core team to join strategic work sessions that the core team prepares and moderates, using different **thematic tables**. During these work sessions the core team informs the parties involved, looks for assessment, enrichment and advice about top-down programme proposals and draws input and advice for bottom-up programme proposals.

Invitations to these work sessions go out to: representatives from the digitalisation coalitions (such as NL AIC, DBC, CoE DSC, Commit2Data, dcypher, FNS), policymakers from various ministries, innovative companies (including SMEs and multinationals) through industry and sector organisations (for example FME, VNO-NCW, NL Digital, CIO-platform), knowledge institutes (such as in the arts, social sciences and natural sciences, IPN and PRIO platforms from academic universities and universities of applied sciences, TNO). Representatives are also invited from the three cross-sectional activities: human capital, valorisation and market creation – financiers of research and innovation (such as NWO, RVO/MIT) – and internationalisation – European and regional initiatives (such as ROMs and EDIHs).

2 The second component is a **broad stakeholder session** that is open to anyone who is interested in the KIA Digitalisation. In the style of a knowledge and innovation market, these broad sessions are used for informing attendees about the developments in the KIA Digitalisation, sharing mature proposals for programming and providing an opportunity to pitch new programming ideas. The sessions also offer opportunities to seek potential partners to form consortiums or coalitions.

3.2 IMPLEMENTATION OF THE PROGRAMMING

The KIA Digitalisation designs its programming using the three pillars of Innovation WITH, Reflection ON and Innovation IN, focusing on pre-competitive knowledge and innovation, rather than on specific (including company-specific) implementation. Since the available resources are limited, programming means making tough choices based on the frameworks outlined under the pillars, but also based on other aspects such as demand (including funding), policy priorities, opportunities, available knowledge and urgency. The ambitions are geared towards focus and mass: the goal is to realise one PPP programme per mission (for a total of five programmes) and two cross-sectional PPP programmes during the 2024-2027 period.

EACH OF THE PILLARS HAS SLIGHTLY A DIFFERENT STRATEGIC FRAMEWORK FOR ITS PROGRAMMING. THESE STRATEGIC FRAMEWORKS PROVIDE GUIDANCE FOR HOW THE PROGRAMMING AND AMBITIONS OF THE SEPARATE PILLARS ARE GIVEN SHAPE:

- **Innovation WITH:** here, the missions are leading. The challenges and questions relating to digitalisation in the mission KIAs create the framework for programming knowledge and innovation. The ambition is to develop a digitalisation programme for each of the missions. The focus is on priority challenges where public and private parties have stated a will and preference for programming and where the mission KIAs are prepared to support with funding.

- **Innovation IN:** the seven DITs and the strategic priorities from the NTS that is being developed and DOSA are leading here. What is important is that programmes in this pillar should offer contributions as platform technology for all the missions. The work is on more generic technology development where public and private parties have stated a will and preference for programming and for which suitable resources are available. This also involves looking at areas where large-scale initiatives are still lacking and where opportunities lie for the Netherlands. The activities for this pillar are coordinated with the KIA KT.

- **Reflection ON:** the frameworks for elements such as Value-Driven Digitalisation are guiding here. Responsible digitalisation requires an integrated approach that also considers new methods, social innovations and social and ethical questions. As such, Reflection ON provides returns in the two other pillars. Every programme is reviewed to determine what aspects need to be considered to facilitate responsible adoption of the technologies, to learn from users/members of the public and to properly understand the social and ethical context.

The KIA Digitalisation endeavours to balance top-down and bottom-up guidance in the programming, to align with strategic priorities and the needs of the sector and society. This serves to maintain an open view of where the energy is and where opportunities arise. Coordination and facilitation are given shape in the structures described under Governance (section 3.1) and Processes and Consultation Structure (section 3.4).

3.3 INSTRUMENTS FOR PROGRAMMING

The KIA Digitalisation's projects and programmes can be financed using a variety of instruments. Several specific instruments are available in particular for the Mission-Driven Top Sectors and Innovation Policy: NWO funding for the Knowledge and Innovation Covenant (KIC), the MIT scheme (for example in the form of networking activities and innovation brokers), the PPP innovation scheme (which individual TKIs can draw on) and, to a lesser extent, the KIA's own contracting/guidance resources (for example for explorations). With these instruments, the KIA Digitalisation can give direct guidance, based on the programming for the three

pillars. These instruments are what the KIA Digitalisation will use primarily, in partnership with other TKIs and similar to other KIAs. Working with multiple TKIs, the KIA Digitalisation will use PPP resources for digitalisation under one of the missions (Innovation WITH) or to develop DITs (Innovation IN).
Other instruments do not offer the possibility of direct guidance. However, use of those instruments can be encouraged and possibly coordinated. The National Growth Fund (NGF) is particularly relevant here. The KIA Digitalisation will emphasise forming coalitions/consortiums for applications under the NGF that match the framework of the KIA Digitalisation.
For NGF processes, for example, the KIA Digitalisation can offer support by providing quartermasters.

THE TABLE BELOW SHOWS THE MOST IMPORTANT INSTRUMENTS FOR THE KIA DIGITALISATION AND HOW THEY RELATE TO THE SEPARATE PILLARS, ACTIVITIES AND METHODS BY WHICH THE KIA DIGITALISATION CAN INFLUENCE THE INSTRUMENTS.

INSTRUMENT	PILLAR			NOTES	ACTIVITY			INFLUENCE	
	Innovation WITH	Reflection ON	Innovation IN		Research	Valorisation	Adoption	Encouragement	Guidance
NGF (RVO)	✓	✓	✓	Specific one-time investments in knowledge development and research, development and innovation.	✓	✓	✓	✓	
PPS-TKI (RVO)	✓	✓		Applications possible for partnership projects. Funding must be used directly for the project and may not replace existing financing.	✓	✓		✓	✓
MIT R&D (RVO)	✓	✓		SME partnerships for developing or updating products, production processes or services.		✓	✓		✓
KIC (NWO)	✓	✓	✓	Contribution to Mission-Driven Top Sectors and Innovation Policy, connecting scientists and scholars and private and public parties.	✓			✓	✓

Other instruments are also available that could be relevant to the KIA Digitalisation, but where the KIA Digitalisation has no influence (at least not directly). These are research and innovation instruments to which the KIA Digitalisation can refer parties and that the KIA Digitalisation can try to align its programming to. Examples include the Small Business Innovation Research (SBIR) scheme that helps (at least indirectly) to encourage innovation in social themes and digitalisation. The same is true of the Dutch participation, through EZK, in European and international programmes such as the Eureka Cluster ITEA4 and the partnerships under Horizon Europe. Companies can also join forces with knowledge institutes to take part, with financial backing from the central government, in Important Projects of Common European Interest (IPCEIs). NWO also offers a range of instruments (including LTP, *Perspectief* and the NWA routes) for public–private research into mission themes and digitalisation.

The table on page 33 shows a selection of those instruments that are beyond the KIA Digitalisation's sphere of influence, but that can have relevance for projects within the framework of the KIA Digitalisation. The KIA Digitalisation will encourage use of these financing options for initiatives relating to digitalisation and DITs that align with the framework of the KIA Digitalisation and arise from actual practice.

INSTRUMENT	PILLAR			NOTES	ACTIVITY		
	Innovation WITH	Reflection ON	Innovation IN		Research	Valorisation	Adoption
SBIR (RVO)	✓	✓		Innovation competition where businesses supply innovative products and services to solve society's questions.		✓	✓
PERSPECTIEF (NWO)	✓	✓	✓	Participants use a multidisciplinary approach to develop new technologies and key enabling technologies.	✓		
LTP (NWO)	✓	✓	✓	Long-term 10-year programmes under which public-private consortiums can apply for grants and subsidies. Part of the KIC.	✓	✓	
NWA (NWO)	✓	✓	✓	Research within the framework of the National Science Agenda (*Nationale Wetenschapsagenda*, NWA), including research into value creation using responsible AI and Big Data.	✓	✓	
ITEA4 (EC)		✓	✓	TEA supports companies in the digital transformation. Calls are set up with ministries of Member States.		✓	✓
DIGITAL EUROPE PROGRAMME (EC)			✓	Funding for themes such as supercomputing, AI, cybersecurity, advanced digital skills and using digital technology. Calls for specific topics.	✓	✓	
HORIZON EUROPE (EC)	✓		✓	Funding for research and innovation in a variety of areas, including digital and various missions. Funding for both fundamental academic research and applied public-private research into global challenges. Calls for specific topics.	✓	✓	
ADRA (EC)			✓	Joint calls relating to AI, Data and Robotics.	✓	✓	
IPCEI (EU)	✓	✓	✓	Every year, various Member States make contributions (public & private) to an IPCEI.	✓	✓	

3.4 PROCESSES AND CONSULTATION STRUCTURE

One of the ambitions of the KIA Digitalisation is to develop at least five PPP programmes, i.e. one for each of the missions. The KIA Digitalisation also has the ambition to develop two cross-sectional programmes during the 2024-2027 period.

Giving shape to these ambitions requires close cooperation with the directors on the core team. Input will also be sought for joint programmes during the work sessions with the advisory council, which includes representatives from the business sector, knowledge institutes, government organisations and existing coalitions and initiatives relating to digitalisation. The programming is both top-down and bottom-up, to align supply (from innovative companies and knowledge institutes) with demand (from the missions and the business sector). Where both sides generate sufficient interest and organisational drive, and where suitable resources and investments are available, they will join forces to set up a programme. The ambitions can only be realised if sufficient resources are made available and sufficient organisational drive is generated.

The process of programming will be given further shape during the period ahead. Since the resources of the KIA Digitalisation are limited, choices will need to be made within the parameters of the KIA Digitalisation's strategic framework. Those choices are prepared by the core team, which manages the portfolio for the KIA Digitalisation.

TO PUT THIS PORTFOLIO TOGETHER, THE KIA DIGITALISATION WORKS:

- **Top-down:** the core team explores the opportunities – or gives instructions for exploring opportunities – for joint programming based on the missions, and discusses programming proposals in work sessions with the advisory council.
- **Bottom-up:** the advisory council puts forward suggestions for joint programming during the work sessions. After the work session they can use a query to submit a programme proposal to the core team. The KIA Digitalisation will set up a process for this, with clearly defined procedures, inspired in part by the Broadly Supported Programmes (*Breed Gedragen Programma's*, BGPs) used by the KIA KT.

Coordinating the programming for the KIA Digitalisation is handled by Topsector ICT.

The relevant contact details can be found through the website of Topsector ICT (www.topsector-ict.nl), including of the chairs and secretaries of the core team and the advisory council.

TOPSECTOR ICT
dutch digital

LIST OF ABBREVIATIONS

ANNEX A

ADR	AI, Data and Robotics
AI	Artificial Intelligence
AWF	Agriculture, Water & Food
BGP	Broadly Supported Programme (*Breed Gedragen Programma*)
BRICKS	Basic Research in Informatics for Creating the Knowledge Society
BSIK	Dutch Subsidies for Investments in the Knowledge Infrastructure Decree (*Besluit Subsidies Investeringen Kennisinfrastructuur*)
BZK	Dutch Ministry of the Interior and Kingdom Relations (*Binnenlandse Zaken en Koninkrijksrelaties*)
CE	Circular Economy
CER	Critical Entities Resilience
CIO	Chief Information Officer
CoE DSC	Centre of Excellence for Data Sharing and Cloud
CS4NL	Cybersecurity for the Netherlands
DBC	Dutch Blockchain Coalition
DEF	Dutch Ministry of Defence (*Defensie*)
DEP	Digital Europe Programme
DESI	Digital Economy and Society Index
DIT	Digital and Information Technology
DOSA	Digital Open Strategic Autonomy
EDIC	European Digital Infrastructure Consortium
EDIH	European Digital Innovation Hub
eIDAS	Electronic Identities and Trust Services
ELSA	Ethical, Legal and Social Aspects
EU	European Union
EZK	Dutch Ministry of Economic Affairs and Climate Policy (*Economische Zaken en Klimaat*)
FAIR	Findable, Accessible, Interoperable and Reusable data
FES	Economic Structure Enhancing Fund (*Fonds Economische Structuurversterking*)
FME	Dutch Metalworking and Electrical Engineering Industry Federation (*Federatie voor de Metaal- en Elektrotechnische Industrie*)
FNS	Future Network Services
GDP	Gross Domestic Product
H&HC	Health & Healthcare
HBO	Higher vocational education (*Hoger beroepsonderwijs*)
HCA	Human Capital Agenda
HTSM	High-Tech Systems and Materials
ICT	Information and communication technology
IPCEI	Important Project of Common European Interest
IPN	ICT Research Platform Netherlands
ITEA4	Information Technology for European Advancement 4
I&W	Dutch Ministry of Infrastructure and Water Management (*Infrastructuur en Waterstaat*)
J&V	Dutch Ministry of Justice and Security (*Justitie en Veiligheid*)
KDT JU	Key Digital Technologies Joint Undertaking
KEM	Key Enabling Methodologies
KIA	Knowledge and Innovation Agenda
KIC	Knowledge and Innovation Covenant
KT	Key enabling technology
LTP	Long-Term Programme
LNV	Dutch Ministry of Agriculture, Nature and Food Quality (*Landbouw, Natuur en Voedselkwaliteit*)
MIT	SME Innovation Stimulus for Top Sectors (*MKB-Innovatie-regeling Topsectoren*)
MMIP	Long-Term Mission-Driven Innovation Programme (*Meerjarig Missiegedreven Innovatieprogramma*)
MTIB	Mission-Driven Top Sectors and Innovation Policy (*Missie-gedreven Topsectoren- en Innovatiebeleid*)
NGF	National Growth Fund
NL AIC	Netherlands AI Coalition
NTS	National Technology Strategy
NWA	National Science Agenda (*Nationale Wetenschapsagenda*)
NWO	Dutch Research Council (*Nederlandse Organisatie voor Wetenschappelijk Onderzoek*)
PHT	Personal Health Train
PPP	Public-private partnership
PRIO	Platform Applied ICT Research (*Platform Praktijkgericht ICT-onderzoek*)
R&D	Research and Development
ROM	Regional Development Company (*Regionale Ontwikkelings-maatschappij*)
RVO	Netherlands Enterprise Agency (*Rijksdienst voor Onder-nemend Nederland*)
SBIR	Small Business Innovation Research
SEC	Society's Earning Capacity
SKIA	Strategic Knowledge and Innovation Agenda
SME	Small and medium-sized enterprises
SNS JU	Smart Networks and Services Joint Undertaking
TKI	Top Consortiums for Knowledge and Innovation (*Topconsor-tia voor Kennis en Innovatie*)
TO2	Federation of Applied Research Organisations (*Toegepast Onderzoek Organisaties*), which includes TNO
TTO	Technology Transfer Office
VWS	Dutch Ministry of Health, Welfare and Sport (*Volksgezond-heid, Welzijn en Sport*)
WO	University education sector (*Wetenschappelijk Onderwijs*)

ANNEX B

DIT – DIGITAL AND INFORMATION TECHNOLOGIES

Table 3 – The seven digital and information technologies.

1 ARTIFICIAL INTELLIGENCE (AI)	Artificial intelligence (AI) is a system technology aimed at realising behaviour in machines that resembles natural intelligence. Artificial intelligence covers a variety of learning strategies. With supervised machine learning, the model/algorithm is capable of making classifications or predictions based on a sample dataset and associated labels. With unsupervised learning, the algorithm makes this categorisation without using existing labels. With reinforcement learning, the algorithm learns about the best strategy through interaction with the environment. Deep learning makes it possible to solve problems with a higher level of complexity and abstraction. Increasingly, hybrid AI forms are being developed where humans and AI work together.
2 DATA SCIENCE, DATA ANALYTICS AND DATA SPACES	Data science, analytics and data spaces (data ecosystems) covers every aspect of gathering, managing, accessing, sharing and analysing data for the purpose of creating value. The data ecosystem contains centralised and distributed databases, plus federative solutions for data sharing. For analysis and value creation, it is important that those data must be FAIR. Systems must also be in place for arrangements governing the use of, access to and value of the data. Data might be structured or unstructured, static or dynamic, and they can be extremely heterogeneous. The value that is extracted from them may take the form of predictions, automated decisions, models learned from data or visualisations that help to understand the data.
3 CYBER SECURITY TECHNOLOGIES	Cyber security technologies are intended to reduce relevant digital risks to an acceptable level. This also covers handling risks of damage to or loss of digital systems and data availability, integrity and confidentiality. Technologies are designed to prevent cyber incidents and – where cyber incidents occur in spite of these precautions – to identify those incidents, limit the damage and make repairs easier.
4 SOFTWARE TECHNOLOGIES AND COMPUTING	Software technologies and computing is about developing methods and techniques for software to make it usable and reliable and capable of being maintained on a permanent basis. One trend here is that technologies are increasingly being used to support distributed architectures. Key examples include blockchains intended for decentralised trust systems, but also cloud, edge, grid, high-performance and mobile computing. At the same time, another trend is that new programming languages, development methods and test environments are becoming more and more dominant, in response to stricter quality requirements and the increased pace of innovation.

DIT – DIGITAL AND INFORMATION TECHNOLOGIES

5 DIGITAL CONNECTIVITY TECHNOLOGIES	Digital connectivity technologies will create a new generation of wired and wireless networks that are capable of meeting the rising demand for capacity, are robust and flexible and are efficient in terms of energy and materials used. Many of these networks will be programmable in order to optimally accommodate the wide diversity of requirements from applications. Examples include the vast bandwidth for networks in high performance computing, the very low latency networks for autonomous driving and industrial applications, and the extremely high security for financial and public sectors.
6 DIGITAL TWINNING AND IMMERSIVE TECHNOLOGIES	Digital Twinning and Immersive technologies are a digital representation of physical processes and systems for digital and autonomous production, analysis and optimisation. Digital twins are used for purposes such as engineering and fabrication technologies for modelling machines and processes, in Life Science and Health and medtech as digital counterparts for organisms (such as human beings). Digital twins are increasingly developing into more interactive and dynamic systems (with the capability to control and adjust processes, for example). Digital twins build on several other digital technologies, such as computing, connectivity and communication technologies, cloud and IoT networks, data science for sharing and analysing data, AI for prediction and immersive technologies for creating realistic experiences and optimum interaction with the artificial, simulated environment. Immersive technologies transform experiences and raise them to a more realistic level by virtually combining the user's sight (images), sounds and even touch.
7 NEUROMORPHIC TECHNOLOGIES	Neuromorphic technologies are about bio-inspired hardware for energy-efficient information processing. 'Neuromorphic' refers to direct models of biological structures, for example neurons and synapses, but also to digital and/or analogue implementations of artificial neural networks like those used in machine learning and robotics. Hardware implementation of neuromorphic technologies can be realised using methods such as memristors, spintronic devices and complex networks of nanomaterials.

Source: Van Bree et al. (2023). Herijking Sleuteltechnologieën 2022. TNO and NWO, March 2023.

TOPSECTOR ICT
dutch digital

THE HAGUE, 3 OCTOBER 2023

This Knowledge and Innovation Agenda (KIA) for Digitalisation has been prepared under the responsibility of Topsector ICT.

Explanation of the process: *This KIA Digitalisation has been created in consultation with dozens of stakeholders from knowledge institutes, government organisations and the business sector, who were consulted in the summer of 2023. During the interviews and sessions making up the stakeholder consultation process, they gave their input and responses to the plans for the KIA Digitalisation. Technopolis Group was instructed by Topsector ICT to gather and analyse that input and incorporate it into the KIA Digitalisation. Topsector ICT then aligned the information with the other KIAs.*

Stakeholders who were consulted in interviews and sessions: *representatives from digitalisation-related coalitions, other Top Sector organisations and their associated TKIs, other KIAs, directorates of relevant government ministries, research financiers, TO2 institutions, academic universities, universities of applied sciences, academic and scientific domains, sector and industry organisations and organisations of companies and business owners.*

EDITORS:

Topsector ICT:

Frits Grotenhuis, Hanneke Jansen and Inald Lagendijk

Technopolis Group:

Chiel Scholten, Christian Erven, Elmar Cloosterman,
Ivette Oomens and Jules van de Meulengraaf

TOPSECTOR
ICT
dutch digital

WWW.TOPSECTOR-ICT.NL