Comparison of AI Strategies in Finland, Sweden and The Netherlands – Case the Netherlands

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Managementsamenvatting

De potentie van kunstmatige intelligentie (AI) om tot grootschalige transformatie te leiden wordt breed erkend. Als gevolg hiervan zijn veel landen begonnen met het ontwikkelen van strategieën, beleid en concrete programma's voor AI-onderzoek, ontwikkeling en innovatie (R&D&I) met uiteenlopende strategische doelen en benaderingen (Jobin, Ienca & Vayena, 2019).

In een drieluik van vergelijkende studies uitgevoerd in parallel door het Technical Research Centre of Finland (VTT), de Research Institutes of Sweden (RISE) en de Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek (TNO) in Nederland, willen we een gedeeld begrip creëren van de overeenkomsten en verschillen tussen respectievelijk de AI-strategieën van Finland (Ailisto et al., 2023), Zweden (Burden et al., 2023) en Nederland.

Daartoe stellen we de volgende vragen:
1. Wat voor soort nationale AI-strategie(ën) en gerelateerd beleid en R&D&I programma's zijn in Nederland geïnitieerd?
2. Wat zijn de overeenkomsten en verschillen met soortgelijke initiatieven in Finland en Zweden?
3. Wat waren de verwachte en werkelijke effecten van deze AI-strategieën, gerelateerd beleid en programma's?

4. Wat zijn mogelijke geleerde lessen voor de toekomst van het Nederlandse AI-beleid en gerelateerde R&D&I programma's?

Om verschillende redenen richten we ons op het identificeren van geleerde lessen in plaats van 'best practices' voor nationale AI-strategieën. Ten eerste is de concrete impact van de uitvoering van AI-strategieën diffuus, lange-termijn en moeilijk te meten. Een "nationale strategie" verwijst vaak naar een groot aantal initiatieven die parallel op een min of meer gecoördineerde manier worden uitgevoerd en waarbij gebruik wordt gemaakt van een hybride beleidsmix.

Ten tweede is de rol van verschillende politieke, sociale en culturele context van elk land moeilijk vast te stellen. Wat in het ene land werkt, hoeft dus in een ander land niet effectief zijn. Toch is het waardevol om andere benaderingen te onderzoeken en daarmee keuzes en ervaringen in het eigen land te (her) evalueren.

Het Nederlandse rapport bevat ook een casestudy over het publiek-private samenwerkingsverband Nederlandse AI Coalitie (NL AIC) en het strategische investeringsprogramma voor AI-onderzoek en -innovatie AiNed, die samen zijn

ontwikkeld. De analyse is uitgevoerd door middel van bureau-onderzoek en semi-gestructureerde interviews met o.a. sleutelfiguren die betrokken waren bij de vormgeving van de Nederlandse nationale AI-strategie en de planning en implementatie van het nationale AI-beleid en de nationale AI-programma's.

Ten aanzien van de analyse geldt de volgende belangrijke specificatie. Door middel van bureau-onderzoek en interviews hebben we een beeld kunnen schetsen van de verschillende AI-gerelateerde initiatieven in Nederland. Middels de interviews hebben we opinieonderzoek gedaan. De uitspraken over effectiviteit en kwaliteit zijn daarom gebaseerd op een synthese van de interviews. Uitspraken over overeenkomsten en verschillen tussen de drie landen komen voort uit een reeks gesprekken tussen de auteurs van de Finse, Zweedse en Nederlandse rapporten.

De Nederlandse AI-strategie

De Nederlandse AI-strategie kan beter worden omschreven als een veelheid aan beleid, initiatieven en programma's met een specifieke focus op AI. Daarin is een gemeenschappelijk element de belangrijke rol die de Nederlandse overheid speelt in het definiëren van de nationale ambitie met betrekking tot AI en het sturen van

de richting van de ontwikkeling daarvan. Dit wordt beschreven in het officiële AI-strategiedocument Strategisch Acieplan voor Artificiële Intelligentie (SAPAI) en geïllustreerd door initiatieven zoals de Nederlandse AI Coalitie (NL AIC) en het strategische investeringsprogramma AiNed (AiNed).

In Nederland is AI in 2018 officieel een zelfstandig beleidsonderwerp geworden. Rond die tijd werd AI aangewezen als een 'sleuteltechnologie'. Tot die tijd was AI een aspect van ander beleid, zoals digitaliseringsbeleid, innovatiebeleid en onderzoeksbeleid; of was het opgenomen in andere initiatieven zoals big data of robotica.

Het initiatief voor een Nederlandse nationale strategie specifiek gericht op AI is genomen door een informeel consortium AI voor Nederland (AINED). In een document dat in oktober 2018 werd gepubliceerd (AINED, 2018), riep het consortium op tot actie om de positie van Nederland in de internationale AI-arena veilig te stellen en de potentiële voordelen van de technologie voor de Nederlandse wetenschap, economie en samenleving te benutten. Samen met een ander rapport dat rond dezelfde tijd werd gepubliceerd door DenkWerk (Blom, Van Dongen & Van Beerschoten, 2018), inspireerde het

document van AINED (2018) de eerste officiële AI-strategie van de Nederlandse overheid. Het ministerie van Economische Zaken en Klimaat (MinEZK) nam een centrale rol op zich: het startte het proces naar het definiëren van een nationale AI-strategie; richtte een Taskforce AI op om het implementatieproces te starten; richtte de Nederlandse AI Coalitie (NL AIC) op; en stelde het strategisch R&D&I Investeringsplan op dat later het AiNed-programma zou worden (Nederland Digitaal, n.d.).

De officiële AI-strategie van de overheid – Strategic Action Plan for Artificial Intelligence (SAPAI) – werd in oktober 2019 gepubliceerd, met als algemeen doel dat "Nederland [in staat is] om de maatschappelijke en economische kansen van AI te verzilveren, en de publieke belangen bij AI te borgen en zo doende bij te dragen aan welvaart en welzijn" (Ministerie van Economische Zaken en Klimaat, 2019, p.6). De acties in het document zijn geclusterd rond drie pijlers, namelijk:

1. Maatschappelijke en economische kansen benutten: de kansen herkennen die AI biedt om maatschappelijke uitdagingen aan te pakken, AI-ondernemerschap stimuleren en optimaal gebruikmaken van AI in de publieke sector;

2. Scheppen van de juiste voorwaarden: onderwijs en vaardigheden, onderzoek en innovatie op het gebied van AI, toegang tot hoogwaardige gegevens en digitale connectiviteit;
3. Versterken van de fundamenten: Bescherming van publieke waarden en mensenrechten, betrouwbare inzet van AI, open en competitieve markten, consumentenbescherming, en veiligheid van burgers, bedrijven en overheden.

De AI-strategie werd vergezeld door twee meer specifieke beleidsbrieven over publieke waarden en mensenrechten (Ollongren, 2019) en juridische waarborgen tegen risico's van data-analyses door de overheid (Dekker, 2019). De verantwoordelijkheid voor de uitvoering van het Nederlandse AI-beleid werd gedeeld door verschillende ministeries, wat een teken was van de belangrijke rol die AI al speelde in verschillende beleidsdomeinen.

SAPAI werd gevolgd door verschillende veranderingen in de benadering van de Nederlandse overheid van digitale en AI-governance. Er volgden ook institutionele veranderingen, waaronder de oprichting van twee nieuwe Directoraten-Generaal en een interdepartementale werkgroep voor digitalisering; en er werd een eerste versie van het Nederlandse algoritmenregister

uitgebracht. De Wetenschappelijke Raad voor het Regeringsbeleid (WRR) werd in 2019 door het MinEZK gevraagd om nader advies uit te brengen over het gebruik van AI in de publieke sector. Het WRR-rapport, dat in 2021 werd gepubliceerd, bevatte 11 aanbevelingen en de kabinetsreactie werd besproken in het parlement.

Partnerschappen en programma's
Een van de initiatieven van de Nederlandse AI-strategie, de Netherlands AI Coalition (NL AIC) werd in 2019 opgericht. De NL AIC, een samenwerking tussen de overheid, het bedrijfsleven, de academische wereld en het maatschappelijk middenveld (de zogenaamde quadruple helix), ging de uitdaging aan om het Nederlandse AI-ecosysteem bijeen te brengen en te organiseren, met als doel de ontwikkeling van AI in Nederland te versnellen en individuele AI-initiatieven van deelnemende organisaties samen te brengen. Terwijl de NL AIC in 2019 begon met 65 lidorganisaties (NL AI Coalitie, 2019), was het aantal in de tweede helft van 2022 gestegen tot bijna 500 (NL AI Coalitie, 2022, 12 oktober).

Financiering voor het opstarten van de activiteiten van de NL AIC kwam van het MinEZK en van deelnemende organisaties in de vorm van bijdragen. Aanvullende financiering voor AI R&D&I werd door

NL AIC verkregen uit het Nederlandse Nationale Groeifonds (NGF). Het succesvolle bod van de NL AIC kreeg een oorspronkelijk budget van 1 miljard euro, dat vervolgens in 2021 werd verlaagd tot 276 miljoen euro voor een periode van 7 jaar. Financiering uit deze bron zou dan door NL AIC via de stichting AiNed worden gekanaliseerd naar individuele projecten voor de ontwikkeling van AI-oplossingen. Hierbij andere bestaande structuren ter beschikking, zoals de Nederlandse Organisatie voor Wetenschappelijk Onderzoek (NWO) en haar dochteronderneming Regieorgaan SIA (SIA), de Rijksdienst voor Ondernemend Nederland (RVO), instellingen voor toegepast onderzoek (TO2) en een publiek gefinancierde private investeringsmaatschappij (InvestNL). Met andere woorden, financiering voor AI R&D&I kan de begunstigden op verschillende manieren bereiken, elk met een specifiek doel: fundamenteel onderzoek, toegepast onderzoek, ondernemerschap, onderwijs.

Een balans vinden die past bij de nationale context

Op basis van de vergelijking van de benaderingen in elk van de drie landen in het aannemen van een nationale AI-strategie, en de thematische analyse van interviews met belanghebbenden, onderscheiden we zes dimensies waarlangs keuzes worden gemaakt:

1. De rol van de (nationale) overheid: variërend van het ondersteunen van bottom-up initiatieven tot top-down leiderschap.
2. Het (her)gebruik van instrumenten: van het gebruik van bestaande (beleidsmatige, financiële, enz.) instrumenten tot de ontwikkeling van nieuwe instrumenten.
3. Mate van inclusie van belanghebbenden en consensusvorming: van inclusieve participatie en afstemming met belanghebbenden tot snelheid van handelen.
4. Nadruk op samenwerking of concurrentie: van brede deelname en samenwerking tussen veel verschillende belanghebbenden tot sterke concurrentie tussen ideeën en consortia.
5. Focus van R&D&I investeringen: van focus op baanbrekend fundamenteel onderzoek tot focus op toegepast AI-onderzoek.
6. Houding ten opzichte van (internationale) samenwerking en positionering: van individuele deelname aan een zogenaamde 'AI race'; tot nauwe (internationale) samenwerking in de ontwikkeling van AI om gemeenschappelijke (wereldwijde) uitdagingen aan te pakken.

Voor elk van de zes dimensies hebben landen niet alleen expliciete, maar ook impliciete strategische keuzes gemaakt bij het ontwikkelen van hun respectieve nationale AI-strategieën. De positionering van de Nederlandse aanpak wordt hieronder beschreven.

1. Rol van de (nationale) overheid

De rol van de Nederlandse overheid werd cruciaal geacht voor AI R&D&I en in het bijzonder voor de NL AIC en AiNed. Echter, ondanks de maatregelen die de nationale overheid heeft genomen of gefaciliteerd om de nationale AI-strategie en de implementatie ervan vorm te geven, zoals beschreven in de voorgaande paragrafen, vonden de geïnterviewden het verloop van het proces erg traag. Het proces van coalitievorming, het bereiken van overeenstemming over een strategie, en de afhankelijkheid van het Nationaal Groeifonds voor financiering werden beschouwd als langdurige processen (ongeveer 3 jaar) die vertragingen met zich meebrachten voor de Nederlandse AI-gemeenschap.

Meer praktische betrokkenheid en responsiviteit van de overheid in alles wat met AI te maken heeft, en breder – ICT en digitalisering – waren andere verbeterpunten die door de geïnterviewden werden genoemd.

De geïnterviewden gaven ook commentaar op de volgorde van prioriteiten. Terwijl Finland zichzelf als belangrijkste ambitie stelde om een koploper op het gebied van AI te worden en de middelen beschikbaar stelde om die ambitie te verwezenlijken (Ailisto et al., 2022), richtte Nederland zich in eerste instantie op het opbouwen van draagvlak en het bereiken van consensus onder belanghebbenden en op het definiëren en afstemmen van beleidsbenaderingen over en tussen ministeries.

Ondanks dat het Strategisch Actieplan voor Artificiële Intelligentie (SAPAI) van 2019, dat uit voorgaande proces voortvloeide, als een beleidsmijlpaal wordt beschouwd, blijft de impact ervan voor de meeste geïnterviewden onduidelijk. Een mismatch van verwachtingen werd ook genoemd tijdens de interviews: Als het de bedoeling van de auteurs van SAPAI dat het een momentopname zou zijn, die niet is opgevolgd door een AI-specifieke strategie, maar door verschillende afzonderlijke initiatieven en beleidsmaatregelen, dan kan ook hier het gebruik van de terminologie "strategisch actieplan" zijn gevolgen hebben gehad.

2. Het (her)gebruik van instrumenten

De Nederlandse AI-strategie zoals geschetst in SAPAI en geïmplementeerd via het AiNed-programma wordt als minder missie-gedreven ervaren dan ander innovatiebeleid. Geïnterviewden zetten vraagtekens bij de geschiktheid van bestaande beleidsinstrumenten en de manieren waarop de strategie wordt gemonitord en geëvalueerd, en suggereren dat er ruimte is voor verbetering.

3. Mate van stakeholder inclusie en consensusvorming

Betrokkenheid van belanghebbenden is een belangrijk thema in de Nederlandse AI-strategie, die streeft naar een inclusieve, quadruple helix samenwerking tussen industrie, overheid, de academische wereld en het maatschappelijk middenveld. In de praktijk blijft het voor alle vier groepen belanghebbenden een uitdaging om deel te nemen - voor sommigen meer dan voor anderen. Vertegenwoordigers van het maatschappelijk middenveld kunnen bijvoorbeeld op hindernissen stuiten zoals beperkte financiering of beperkte technologische kennis. Voor start-ups kunnen bureaucratie, (gebrek aan) snelheid van handelen en concurrentie

de belangrijkste hindernissen zijn. Een andere ambitie van de nationale AI-strategie is om ook sectorale en regionale belangen te integreren. Het integreren van alle prioriteiten en belangen op een samenhangende manier wordt een evenwichtsoefening, waarbij het onwaarschijnlijk is dat alle betrokkenen altijd tevreden zullen zijn.

Dit Nederlandse bestuursmodel van 'polderen' (d.w.z. consensusvorming) verschilt fundamenteel van dat van andere EU-lidstaten, vooral wanneer het wordt toegepast op de nationale AI-strategie. In andere landen kan dit komen doordat één categorie belanghebbenden een dominante rol speelt (bijvoorbeeld de industrie in Zweden) of doordat wendbaarheid prioriteit krijgt boven consensusvorming (bijvoorbeeld in Finland). Over het geheel genomen werd de Nederlandse aanpak gekenmerkt als relatief minder flexibel.

4. Nadruk op samenwerking of concurrentie

Nederland koos er voor om, via het MinEZK, AI R&D&I-financiering beschikbaar te stellen via een collectief voorstel. Het schrijven van het voorstel, gecoördineerd door AiNed, werd een uitdagende onderneming. Een van de uitdagingen was het samenbrengen van een hybride groep belang-

hebbenden: industrie, academische wereld, overheid, maatschappelijke organisaties, die elk verschillende belangen vertegenwoordigden en verschillende werkwijzen voorstonden. Een verwante uitdaging was het behouden van focus en samenhang binnen het voorstel om de overkoepelende nationale AI-strategie en haar ambities te weerspiegelen. In de gegeven context blijft het risico op fragmentatie groot, waardoor sommige geïnterviewden zich afvragen of dit een haalbare doelstelling is.

5. Focus van R&D&I investeringen

De Nederlandse strategie voor AI geeft prioriteit aan toepassingen die de samenleving als geheel ten goede komen, wat een voorkeur voor toegepast onderzoek boven fundamenteel onderzoek zou kunnen impliceren. Geïnterviewden geven echter aan dat er bij de implementatie van de AI-strategie, bijvoorbeeld door AiNed-financiering, een verschuiving heeft plaatsgevonden naar meer fundamenteel AI-onderzoek. Een van de verklaringen was dat bestaande financieringsinstrumenten mogelijk niet geschikt zijn voor AI. Een andere reden die werd genoemd, was de complexiteit van het R&D&I-landschap voor AI en de bestaande organisatorische en institutionele structuren die het moeilijk kunnen maken om bepaalde begunstigden te bereiken.

Finland staat voor soortgelijke uitdagingen, waar een deel van de beschikbare R&D&I-financiering voor AI de beoogde begunstigden niet bereikt (Ailisto et al., 2022). Ondertussen richt de Zweedse AI-strategie zich meer op de toepassing van AI door de publieke sector en is het belangrijkste investeringsprogramma gericht op fundamenteel onderzoek (Burden et al., 2023).

6. Houding ten opzichte van (internationale) samenwerking en positionering

Net als Finland en Zweden sluit Nederland goed aan bij de ambities en waarden van de Europese Unie (EU) met betrekking tot AI. Wetgevings- en beleidsinitiatieven van de EU (zoals het voorstel voor een verordening inzake kunstmatige intelligentie, de AI-wet, of het programma Digitaal Europa) hebben een sterke invloed op

nationale strategieën. Er blijven echter ook belangrijke nationale verschillen bestaan, vooral op tactisch en operationeel niveau.

Bovendien streeft Nederland, net als Zweden en Finland, actief naar internationale samenwerking op het gebied van AI R&D&I. Maar hoewel EU-lidstaten worden beschouwd als waardevolle partners in dergelijke samenwerkingsverbanden, kunnen ze soms ook concurrenten zijn. Concurrentie om schaars AI-talent was een van de voorbeelden die tijdens verschillende interviews werden genoemd. Finland werd genoemd als een van de landen die AI-talent uit andere EU-landen aantrekt, wat mogelijk te maken heeft met het actieve beleid van het land om carrièremobiliteit aan te moedigen als middel om kennisoverdracht te stimuleren (Ailisto et al., 2022).

Conclusie

Er is geen standaardmodel voor een nationale AI-strategie dat in elk land kan worden toegepast. De lessen uit onze vergelijking en de casestudy geven echter aan dat landen bepaalde praktijken en uitdagingen delen en dat, ongeacht de nationale context, het ontwikkelen en onderhouden van een nationale AI-strategie het beste kan worden gezien als een continu proces van leren, reflectie en aanpassing. Regelmatige toetsing van de algemene ambities ten aanzien van AI, monitoring van de resultaten en waar nodig bijstelling van de aanpak, keuzes en instrumenten zijn daarom sterk aan te bevelen.

Executive summary

The transformative potential of Artificial Intelligence (AI) has been broadly recognised. As a result, many countries have started developing strategies, policies and concrete programmes for AI research, development, and innovation (R&D&I) with diverse strategic goals and approaches (Jobin, Ienca & Vayena, 2019).

In a trilogy of comparative studies conducted in parallel by the Technical Research Centre of Finland (VTT), the Research Institutes of Sweden (RISE) and the Netherlands Organisation for Applied Scientific Research (TNO), we aim to create a shared understanding of the commonalities and differences between the respective AI strategies of Finland (Ailisto et al., 2023), Sweden (Burden et al., 2023) and the Netherlands. To that extent, we ask the following questions:

1. What kind of national AI strategies and related policies and R&D&I programmes have been initiated in the Netherlands?
2. What are their commonalities and differences with similar initiatives in Finland and Sweden?
3. What were the expected and actual impacts of these AI strategies, related policies and programmes?
4. What are possible lessons learned for the future of the Netherlands AI policies and related R&D&I programmes?

We focus on identifying lessons learned rather than 'best practices' for national AI strategies for several reasons. First, concrete impacts of AI strategies are diffuse, long term, and difficult to measure. "National strategy" often refers to a multitude of initiatives running in parallel in a more or less coordinated way and making use of a hybrid policy mix to implement them. Second, the role played by differences in the political, social and cultural contexts of each country is difficult to ascertain. Thus, what works in one country, may not be effective in another. Nevertheless, it is valuable to examine other approaches in order to (re)evaluate choices and experiences gained in one's own country.

The Dutch report also includes a case study featuring the public-private partnership Netherlands AI Coalition (NL AIC) and the strategic AI research & innovation investment programme AiNed, both developed in conjunction The analysis was performed through desk research and semi-structured interviews with i.a. key persons who participated in shaping the Dutch national AI strategy and the planning and implementation of the national AI policies and programmes.

Regarding the analysis, the following important specification applies. Through desk research and interviews, we were able to paint a picture of the various AI-related initiatives in the Netherlands. Through the interviews we conducted opinion research. The statements regarding effectiveness and quality are therefore based on a synthesis of the interviews. Statements made about similarities and differences between the three countries stem from a series of conversations between the authors of the Finnish, Swedish and Dutch reports.

The Dutch AI strategy

The Dutch AI strategy would be more accurately described as a multitude of policies, initiatives and programmes with a specific focus on AI. One element common to all is the important role played by the Dutch government in defining the national ambition with regard to AI and steering the direction of its development. That is outlined in the official AI strategy document Strategisch Acieplan voor Artificiële Intelligentie (SAPAI) and exemplified by initiatives such as the Netherlands AI Coalition (NL AIC) and the AiNed strategic investment programme (AiNed).

In the Netherlands, AI officially became a standalone policy topic in 2018. Around that time, AI was designated as one of the 'key enabling technologies'. Until then, AI had been an aspect of other policies, such as digitalization policy, innovation policy and research policy; or was included in other initiatives such as big data or robotics.

The initiative for a Dutch national strategy aimed specifically at AI was taken by an informal consortium AI voor Nederland (AINED). In a document published in October 2018 (AINED, 2018), the consortium called for action to secure the position of the Netherlands in the international AI arena and reap the potential benefits of the technology for Dutch science, economy and society. Together with another report published around the same time by thinktank DenkWerk (Blom, Van Dongen & Van Beerschoten, 2018), the AINED (2018) document inspired the first official AI strategy of the Netherlands government. The Ministry of Economic Affairs and Climate Policy (MinEZK) took on a central role: it started the process towards defining a national AI strategy; set up a Taskforce AI to start the implementation process; set up the Netherlands AI Coalition (NL AIC); and drafted the strategic R&D&I Investment plan which would later become the AiNed programme (Nederland Digitaal, n.d.).

The official government AI strategy – Strategic Action Plan for Artificial Intelligence (SAPAI) – was published in October 2019, spelling out the overall goal that "the Netherlands is able to redeem the societal and economic opportunities, and protecting the public interests, thus contributing welfare and wellbeing" (Ministry of Economic Affairs and Climate Policy, 2019, p.6).

Actions foreseen in the document were clustered around three pillars, namely:
1. Capitalizing on societal and economic opportunities: recognizing the opportunities AI offers to tackle societal challenges, stimulating AI entrepreneurship and making optimal use of AI in the public sector;
2. Providing necessary framework conditions: education & skills, research & innovation in AI, access to high quality data and digital connectivity;
3. Strengthening the foundational elements: protecting public values and human rights, trustworthy use of AI, open and competitive markets, consumer protection, and safety of citizens, businesses, and governments.

The AI strategy was accompanied by two more specific policy letters about public values and human rights (Ollongren, 2019) and legal safeguards against risks of data analyses by the government (Dekker,

2019). The responsibility for carrying out the Dutch AI policy was shared by several ministries, signalling the important role AI was already playing in several policy domains.

SAPAI was followed by several changes in the approach of the Netherlands government to digital and AI governance. Institutional changes followed as well, including the setting up of two new Directorates-General and an interdepartmental working group on digitalisation; and a first version of the Dutch algorithm register was released. The Netherlands Scientific Council for Government Policy (WRR) was requested by the MinEZK in 2019 to provide further advice on the use f AI in the public sector. The WRR report, published in 2021, made 11 recommendations and the Cabinet's response was debated in Parliament.

Partnerships and programmes
One of the initiatives of the Dutch AI strategy, the Netherlands AI Coalition (NL AIC) was set up in 2019. A collaboration between government, industry, academia, and civil society (the so-called quadruple helix), NL AIC took on the challenge of rallying up and organizing the Dutch AI ecosystem, aiming to speed up the development of AI in the Netherlands and bring together individual AI initiatives

of participating organisations. While the NL AIC started in 2019 with 65 member organisations (NL AI Coalitie, 2019), by the second half of 2022 the number had increased to almost 500 (NL AI Coalitie, 2022, October 12).

Funding to kickstart activities of the NL AIC came from MinEZK, as well as from participating organisation in the form of contributions. Additional funding for AI R&D&I was secured by NL AIC from the Dutch National Growth Fund (NGF). The successful bid of NL AIC was awarded an original budget of € 1 billion, subsequently reduced in 2021 to € 276 million to cover a period of 7 years. Funding from this source would then be channelled from NL AIC through the AiNed foundation to individual projects aiming to develop AI solutions. Other existing structures are available for this process, such as the Netherlands Organization for Scientific Research (NWO) and its subsidiary Taskforce for Applied Research SIA (SIA), the Netherlands Enterprise Agency (RVO), applied research institutes (TO2) and a publicly funded private investment agency (InvestNL). In other words, funding for AI R&D&I can reach beneficiaries through a variety of ways, each serving a specific purpose: fundamental research, applied research, entrepreneurship, education.

Finding a balance that suits the national context
Based on the comparison of approaches to adopting a national AI strategy in each of the three countries, and the thematic analysis of interviews with stakeholders, we distinguish six dimensions along which choices are made:
1. The role of the (national) government: ranging from supporting bottom-up initiatives to top-down leadership.
2. The (re)use of instruments: ranging from use of existing (policy, financial, etc.) instruments to development of new instruments.
3. Degree of stakeholder inclusion and consensus building: ranging from inclusive stakeholder participation to speed of action.
4. Emphasizing collaboration or competition: ranging from broad participation and collaboration among many categories of stakeholders; to high competition between ideas and consortia.
5. Focus of R&D&I investment: ranging from focus on ground-breaking fundamental research to focus on applied AI research.
6. Attitude towards (international) collaboration and positioning: ranging from individual participation in a so-called 'AI race'; to close (international) cooperation on developing AI to address shared (global) challenges.

For each of the six dimensions countries made not only explicit, but also implicit strategic choices in developing their respective national AI strategies. The positioning of the Dutch approach is described below.

1. The role of the (national) government

The role of the Dutch government was considered crucial for AI R&D&I in general and for the NL AIC and AiNed in particular. However, despite the measures undertaken or facilitated by the national government to shape the national AI strategy and its implementation, as described in the previous sections, the interviewees found the process too sluggish. The process of coalition-building, agreeing on a strategy, and relying on the Netherlands Growth Fund for funding were considered lengthy processes (about 3 years) bringing about delays for the Dutch AI community.

More hands-on involvement and respon-siveness of government in all matters AI, and broader – ICT and digitisation - were other areas of improvement mentioned by the interviewees.

Interviewees also commented on the order of priorities. While Finland set itself as main ambition to become an AI frontrunner and made available the means

to achieve that ambition (Ailisto et al., 2022); the Netherlands focused initially on building support and reaching consensus amongst stakeholders and on defining and finetuning policy approaches across and between ministries.

Despite the resulting Strategic Action Plan AI (SAPAI) of 2019 being regarded as a policy milestone, its impact remains unclear to most interviewees. A mismatch of expectations was also mentioned during interviews: If the authors of SAPAI intended for it to be a snapshot, which has not been followed up by an AI-specific strategy but by different separate initiatives and policies, then here, too, the use of the terminology "strategic action plan" may have had its consequences.

2. The (re)use of instruments

The Netherlands AI strategy as outlined in SAPAI and implemented through the AiNed programme is perceived as less mission-oriented than other innovation policies. Interviewees questioned the suitability of existing policy instruments, the ways in which the strategy is monitored and evaluated, suggesting that there is room for improvement..

3. Degree of stakeholder inclusion and consensus building

Stakeholder involvement is a key theme in the Netherlands AI strategy, which strives for an inclusive, quadruple helix collaboration involving industry, government, academia and civil society. In practice, it remains challenging for all four stakeholder groups to participate – some more so than others. Civil society representatives, for example, might encounter barriers such as limited funding or limited technological knowledge. For start-ups, main hurdles could be bureaucracy, (lack of) speed of action, and competition. Another ambition of the national AI strategy is to be inclusive of sectoral and regional interests as well. Integrating all priorities and interests in a coherent way becomes a balancing act, unlikely to always satisfy all those involved.

This Dutch so-called 'poldering' (i.e. consensus-building) model of governance is fundamentally different from those of other EU Member States, especially when applied to the AI national strategy. In other countries this may come down to one category of stakeholders holding a dominant role (e.g. industry in Sweden), or to agility being prioritised over consensus building (i.e. in Finland). Overall, the Dutch approach was characterised as comparatively less agile.

4. Emphasizing collaboration or competition

The Netherlands, through the MinEZK, chose to make AI R&D&I funding available through a collective proposal. The writing of the proposal coordinated by AiNed became a challenging undertaking. One of the challenges was that of bringing together a hybrid groups of stakeholders: industry, academia, government, the civil society, each representing different interests and favouring different ways of working. A related challenge was that of maintaining focus and coherence within the proposal to reflect the overarching national AI strategy and its ambitions. In the given context, the risk of fragmentation remains high, leaving some of the interviewees questioning whether this is an achievable objective.

5. Focus of R&D&I investment

The Netherlands strategy for AI prioritises applications that benefit society at large, which could imply a preference for applied research over fundamental research. Interviewees, however, indicated that in the implementation of the AI strategy, for example through AiNed funding, there has been a shift towards more fundamental AI research. One of the explanations given was that existing funding instruments may not be suitable for AI. Another reason mentioned was the complexity

of the AI R&D&I landscape and existing organisational and institutional structures which might make it difficult to reach certain beneficiaries.

Finland faces similar challenges, where part of available AI R&D&I funding is sill to reach its intended beneficiaries (Ailisto et al., 2022). Meanwhile, the Swedish AI strategy focuses more on public sector uptake of AI, and the main investment programme is geared towards fundamental research (Burden et al., 2023).

6. Attitude towards (international) collaboration and positioning

Like Finland and Sweden, the Netherlands is well-aligned with the ambitions and values of the European Union (EU) regarding AI. EU legislative and policy initiatives (such as the proposal for a regulation on Artificial Intelligence, the AI Act; or the Digital Europe programme) have a strong influence on national strategies. However, significant national differences also remain, especially at tactical and operational levels.

Furthermore, the Netherlands, like Sweden and Finland, is actively pursuing international collaborations on AI R&D&I. But while EU Member States are regarded as valuable partners in such collaborations, on occasion they can be competitors, too. Competition for scarce AI talent was one of the examples mentioned during several interviews. Finland was named as one of the countries attracting AI talent from other EU countries, possibly linked to the country's active policy of encouraging career mobility as a means to stimulate knowledge transfer (Ailisto et al., 2022).

Conclusion
There is no standard model for a national AI strategy that can be applied in every country. However, the lessons learned from our comparison and the case study indicate that countries share certain practices and challenges; and that, regardless of the national context, developing and maintaining a national AI strategy is best viewed as a continuous process of learning, reflection and adaptation. Regular reviews of overall ambitions regarding AI, monitoring of results and where necessary adjustments of approaches, choices and tools are therefore highly recommended.

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List of terms and abbreviations

AI	Artificial Intelligence
AINED, AiNed	AI Voor Nederland (AI for the Netherlands)
AIREA-NL	Artificial Intelligence Research Agenda for the Netherlands
ACD	Ambtelijke Commissie Digitalisering (Interdepartmental Committee Digitalisation)
DFKI	Deutsches Forschungszentrum für Künstliche Intelligenz (German Research Centre for Artificial Intelligence)
DTF	Deep Tech Fund
ELSA	Ethical, Legal, Social Aspects
IBM	International Business Machines Corporation
ICAI	Innovation Center for Artificial Intelligence
ICT	Information and Communication Technology
MinBZK	Ministerie van Binnenlandse Zaken en Koninkrijksrelaties (Ministry of the Interior and Kingdom Relations)
MinEZK	Ministerie van Economische Zaken en Klimaat (Ministry of Economic Affairs and Climate Policy)
MinFin	Ministerie van Financiën (Ministry of Finance)
MinOCW	Ministerie van Onderwijs, Cultuur en Wetenschap (Ministry of Education, Culture and Science)
MIT	Mkb-innovatiestimulering Regio en Topsectoren (SME innovation stimulation)
MKB	Midden- en Kleinbedrijf (See SME)
NGF	Nationaal Groeifonds (National Growth Fund)
NGO	Non-Governmental Organisation
NL AIC	Nederlandse AI Coalitie (Netherlands AI Coalition)
NWA	Nationale Wetenschapsagenda (Dutch Research Agenda)

NWO	Nederlandse Organisatie voor Wetenschappelijk Onderzoek (Dutch Research Council)
PPP	Public-private partnership
R&D&I	Research, Development & Innovation
RISE	Research Institutes of Sweden
RVO	Rijksdienst voor Ondernemend Nederland (Netherlands Enterprise Agency)
SAPAI	Strategic Action Plan Artificial Intelligence
SIA	Nationaal Regieorgaan Praktijkgericht Onderzoek SIA (Taskforce for Applied Research SIA)
SME	Small- and Medium-sized Enterprise
TNO	Toegepast Natuurwetenschappelijk Onderzoek (Netherlands Organisation for Applied Scientific Research)
TO2	Toegepast Onderzoek Organisaties (Applied Research Organisations)
TRL	Technology Readiness Level
VNO-NCW	Verbond van Nederlandse Ondernemingen – Nederlands Christelijk Werkgeversverbond (The Confederation of Netherlands Industry and Employers)
VTT	VTT Technical Research Centre of Finland
WBSO	Wet Bevordering Speur- en Ontwikkelingswerk (Tax Credit for Research and Development)
WRR	Wetenschappelijke Raad voor het Regeringsbeleid (Scientific Council for Government Policy)

Acknowledgements

1 Introduction

Artificial Intelligence (AI) is considered a 'general purpose technology' with the potential to drive transformative change for practically every aspect of society (Bakker & Korsten, 2020). As many countries recognize this potential, and some even speak of an 'AI race', some have developed strategies, policies and programmes for research, development, and application of AI (Jobin, Ienca & Vayena, 2019).

Given the many different strategies, the question arises: what is the best way to form an AI strategy? However, this is a hard question to answer for three reasons. First, evaluating (innovation) policy is notoriously hard, as impact is often made in a diffused and long term way (Stern et al, 2012). Second, countries have different starting points and unique characteristics which makes it difficult to objectively generalize and compare whether a strategy will work for others. Third, strategic decision-making happens infrequently, is ill-structured, and outcomes are uncertain (Eisenhardt, 1992) – which makes it hard to learn and adapt regularly. Thus, strategies that are effective in one country, may not be effective in another. Nevertheless, to view other approaches, especially in light of experiences gained in the own country.

Therefore, it is wise to initially focus on lessons learned for existing strategies. In a trilogy of comparative studies conducted by the Technical Research Centre of Finland (VTT), the Research Institutes of Sweden (RISE) and the Netherlands Organisation for Applied Scientific Research (TNO), our aim is to create a shared understanding of the commonalities and differences between the respective AI strategies of Finland, Sweden and the Netherlands. For an case analysis of the AI strategy of Finland and Sweden we refer the reader to resepectively (Ailisto et al., 2023) and (Burden et al., 2023).

The aim of this report is to describe and analyse the AI policy and programmes in the Netherlands, by answering the following questions:

1. What kind of national AI strategies and related policies and R&D&I programmes have been initiated in the Netherlands?
2. What are their commonalities and differences with similar initiatives in Finland and Sweden?
3. What were the expected and actual impacts of these AI strategies, related policies and programmes?
4. What are possible lessons learned for the future of the Netherlands AI policies and related R&D&I programmes?

As the AI landscape of the Netherlands is large, we have conducted a case study of the public-private partnership (Netherlands AI Coalition) and strategic AI research & innovation investment programme (AiNed) that developed with the national AI strategy. The analysis was performed through desk research and semi-structured interviews with key persons who participated in the planning and implementation of the national AI policies and programmes.

Moreover, this report examines only national policies and strategies where AI is central. Other national policies and programmes including AI but focusing primarily on other topics (e.g. digitalisation agenda for primary education or the industry 4.0 policy) were not part of the research; other significant initiatives are briefly mentioned in section 2.3.5.

Finally, this report is structured as follows. Section 2 describes the Netherlands AI policies and programmes. Section 3 contains a case study of a specific part of the AI strategy, namely the Netherlands AI Coalition and AiNed. Section 4 compares the AI strategy of the Netherlands with those of Finland and Sweden. Section 5 contains the conclusion.

2 Netherlands AI strategy and implementation

Within a period of around 10 years, starting in 2011, the digital technology policies of the Netherlands developed and matured, building on a history of innovation and digitalization policy. However, AI as a separate policy topic matured later, and the first three cabinets (2008-2022) of prime minister Mark Rutte did not mention AI in their coalition agreements. AI was not a priority as an independent subject until 2018, around the time when it was recognized as a 'key enabling technology'. The 'maturing' becomes evident when viewing the strategies, policies and programmes that touch upon AI research, development and innovation (R&D&I). Between 2011 and 2023, many developments took place in digitalisation policy, innovation policy, research policy, and AI-specific policy (see Figure 2.1).

Figure 2.1 also shows that the Dutch national AI strategy does not exist as one single effort. Instead, there are several that either have a significant AI component or where AI is at the heart of their agenda. As such the Dutch AI strategy is not centrally managed with potential overlaps or areas insufficiently addressed..
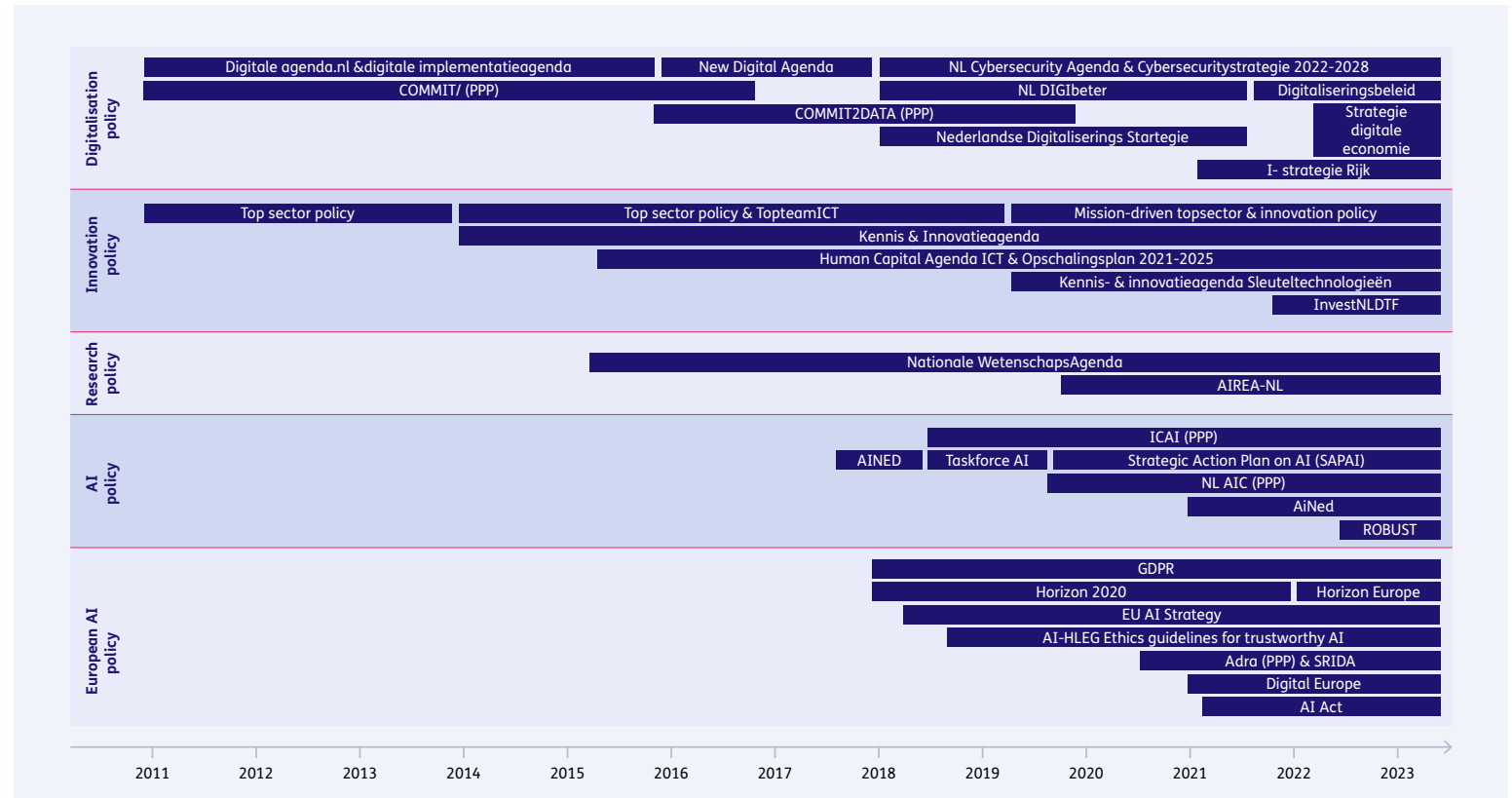
Figure 2.1. Timeline showing the evolution of the Netherlands strategy, policy and programme landscape between 2011-2023 in relation to AI – including partnerships (PPP). Specifically digitalisation (government and society) policy, innovation and economic policy, research policy, and AI-specific policy. For reference, European AI policy, laws and programmes have been added. The full list of events is found in Appendix C. (Source: Authors' own).

Thus, for the purpose of this analysis, we focus on two initiatives where the Dutch government has or has had an important role. This is the Strategic Action Plan Artifical Intelligence (SAPAI) and the combination of Netherlands AI Coalition and the AiNed strategic investment programme. The combination of these two initiatives has the widest ambition in terms of scope of participants and are drivers of a truly national approach to AI. Taken together, we define these as the national AI strategy. Other important AI research and innovation efforts undertaken for instance by ICAI, Appl.AI and other multi-stakeholder initiatives contribute also to the Dutch AI landscape but do not bring the same overall national scope.

This section further describes the Netherlands AI strategy as follows: Section 2.1 describes the situation prior to the national strategy document (2011-2019), Section 2.2 describes the Strategic Action Plan AI (2019), and section 2.3 details the implementation of the strategy (2019-2023).

2.1 Before a national AI strategy

By 2018, the Netherlands was in a favourable position in terms of AI and digitalization: strong technological infrastructure, digitally skilled population and functioning public-private partnerships (SAPAI, 2019). AI research in the Netherlands has grown between 2013 and 2018, and despite the relatively low number of publications (1,3% of worldwide AI publications) is considered high quality, with an above-average citation index (Rathenau Instituut, 2021).

AI was an aspect of wider policies, often under the flag of big data or robotics (manufacturing industry). The Dutch digitalization policy (Digital agenda.nl, DIGIbeter) was focused on Information and Communication Technology (ICT), while the innovation policy (Top sectors) considered ICT a horizontal aspect of all sectors. In science policy, funding of universities and applied scientific research institutes has built a strong base in AI research (Rathenau Instituut, 2021). Between 2011-2015, a total of €19.3 million was invested in ICT-innovation by the ministry of Economic Affairs (Poel, Kokkeler, Oomens & Zuijdam, 2017). The lobby for more emphasis on ICT resulted in the installation of a Top Team ICT in 2014. The Top Team ICT produced an ICT research & innovation strategy with a budget of €40 million for a period of three years (KIA-ICT 2016-2019). Despite the increase in funding and a more defined strategy, the policies received only an adequate evaluation in 2017. The Rathenau Insitute found that government, regulators, industry and society were not well equipped for digitalization (Kool, Timmer, Royakkers & Van Est, 2017) and, while ICT issues such as standardization, infrastructure, data storage or cyber security were covered by national Public-private partnerships (PPP) such as Smart Industry – there was not yet a wide national AI initiative to which the ICT policy could latch on (Poel et al., 2017).

The initiative for a Dutch national strategy aimed specifically at AI was taken by AI voor Nederland (AINED), a small informal group consisting of organizations representing employers in the private sector, industry, applied and fundamental research[1]. In October 2018, they published a document (AINED, 2018), intended as a call-to-action to secure the position of the Netherlands in the international AI arena and reap the potential benefits of the technology for Dutch science, economy and society. Together with another report published by thinktank DenkWerk (Blom, Van Dongen & Van Beerschoten, 2018) around the same time, the AINED (2018) document inspired the first official AI strategy of the Netherlands government. The Ministry of Economic Affairs and Climate Policy (MinEZK) started the process towards a national AI strategy and set up a Taskforce AI[2] to start with the implementation of the necessary actions, such as writing a position paper (Taskforce AI, 2019), setting up the Netherlands AI Coalition and drafting a strategic R&D&I investment plan which would become the AiNed programme (Nederland Digitaal, n.d.).

2.2 Strategisch Actieplan voor Artificiële Intelligentie (SAPAI)

Entitled Strategic Action Plan for Artificial Intelligence, the official government AI strategy was published in October 2019 under the guidance of the MinEZK. The strategy presents the vision that "the Netherlands is able to redeem the societal and economic opportunities, and protecting the public interests, thus contributing welfare and wellbeing" (Ministry of Economic Affairs and Climate Policy, 2019, p.6) and aims "to create and benefit from societal and economic opportunities and protect the public interests, thus contributing to welfare and

1. The AINED consortium consisted of: Topteam Dutch Digital Delta, VNO-NCW, ICAI, NWO, TNO, and was supported by Boston Consulting Group and DenkWerk (AINED, 2018).
    While somewhat similar in composition, this is a different group than the one behind the AiNed investment programme.
2. The Taskforce AI consisted of: VNO-NCW, MinEZK, IBM, Philips, TNO, Topteam Dutch Digital Delta, Seedlink, Ahold Delhaize (Taskforce AI, 2019).

wellbeing" (Ministry of Economic Affairs and Climate Policy, 2019, p.7). This Dutch AI strategy groups policies within three strategic pillars, aiming at:

1. Capitalizing on societal and economic opportunities – recognizing the opportunities AI offers to tackle societal challenges, stimulating AI entrepreneurship and making optimal use of AI in the public sector;
2. Creating the right conditions – education & skills, research & innovation in AI, access to high quality data and digital connectivity;
3. Strengthening the foundations – protecting public values and human rights, trustworthy use of AI, consumer protection, and safety of citizens, businesses, and governments.

Furthermore, the AI strategy was accompanied by two more specific policy letters, showing the relevance of AI in multiple policy domains:

1. 'AI, public values and human rights', from the Ministry of the Interior and Kingdom Relations (MinBZK), which gives an overview of the risks and opportunities that AI brings about and

describes policy measures to mitigate risks (Ollongren, 2019).

2. 'Safeguards against risks of data analyses by the government', from the ministry of Justice and Security, informing Parliament about possible legal safeguards to prevent risks from data analyses by the government (Dekker, 2019).

Institutionally, SAPAI is not supported by a dedicated government outfit (i.e. something akin to a "Ministry of AI") but is distributed across several ministries. AI policy issues may be addressed by the interdepartmental working group on digitalisation (ACD), by the department for digitalisation (within the MinBZK), by the department for Economy & Digitalization (within the MinEZK), or by other national government departments. Changes that occurred since are detailed in Section 2.3.1.

2.3 Implementation, programmes and partnerships

This section describes the policies, programmes and partnerships aimed at R&D&I activities for AI, namely adaptations to the existing governance (section 2.3.1), the use of existing R&D&I investment

structures (section 2.3.2), setting up the Netherlands AI Coalition (section 2.3.3), developing the AiNed strategic invetment programme (section 2.3.4), and other AI R&D&I programmes, such as ICAI and Appl.AI (section 2.3.5).

2.3.1 Adaptations to policy and governance

The intended implementation actions to be undertaken are described in SAPAI (2019). In particular this consisted of the development of a national PPP (NL AIC), and drafting a strategic R&D&I investment programme for the Netherlands (AiNed).

Meanwhile, cabinet-Rutte IV started early 2022 as the first Dutch cabinet with a digitalization portfolio in their coalition agreement (Rijksoverheid, 2022). The Minister for Kingdom Relations and Digitalisation presented a policy letter for digitalisation (Van Huffelen et al., 2022) and an agenda that further specifies how they aim to achieve those policy goals (Ministry of the Interior and Kingdom Relations, 2022). The MinEZK produced a strategy for the digital economy (Ministry of Economic Affairs and Climate Policy, 2022). Several changes in the AI governance of the Netherlands were

the introduction of a new directorate-general 'Economy and Digitalisation' within the MinEZK; and the directorate-general 'Digital Society' within the MinBZK. Moreover, an interdepartmental committee for digitalization (NL: Ambtelijke Commissie Digitalisering) has been installed, and a first version of the Dutch algorithm register[3] has been published online (Ministry of the Interior and Kingdom Relations, 2022).

In the years after the publication of SAPAI, a policy advice phase took place. This was triggered by the MinEZK, who requested advice from the Netherlands Scientific Council for Government Policy (WRR). The WRR report[4] was published in November 2021, emphasizing the systemic nature of AI's impact on society (Wetenschappelijke Raad voor het Regeringsbeleid, 2021) and, in order to improve embedding of AI in society, the WRR made 11 recommendations to government in five themes: 1) demystification (learning about AI, stimulating 'AI wisdom' among general public); 2) contextualising (choosing an 'AI identity' and enhancing the skills of individuals working with AI); 3) engagement (strengthening the capacity of civil society and ensuring strong feedback loops

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between AI users, developers and those who experience the consequences); 4) regulating (developing a broad strategic regulatory agenda, and use regulation to actively steer developments of surveillance, concentration of power); and 5) positioning (forming AI diplomacy focused on international cooperation and strengtening capacities to compat information warfare). In particular, the WRR recommended the setup of a policymaking infrastructure for AI (starting with an AI coordination centre in the political process). A Cabinet's response followed in October 2022, and in the first quarter of 2023 it was debated by the parliamentary committee of digital affairs.

2.3.2 Use of existing R&D&I coordination structures
Broadly speaking, several instruments are employed by public authorities to promote R&D&I. Amongst these instruments are fiscal benefits, themed subsidies, legislative measures, prioritising certain policy issues, and strategizing (e.g. by taking the initiative for public-private partnerships). Public funding of R&D&I is often granted via open calls, so that there is competition and transparency. Public funding is also used in a private investment fund with venture capital for start-ups, although this is not used by the AiNed strategic investment programme.

The programmes and partnerships set up under the national AI strategy are embedded in larger, more general structures that already have been established. For example, public funding of research (including research into AI) is coordinated by the Dutch Research Council (NWO) and its subsidiary Regieorgaan SIA (Taskforce for Applied Research SIA, or SIA) which is focused on applied research. Investment in fundamental and applied R&D&I occurs through either NWO, SIA or RVO calls and subsidies. In addition, funding for applied research is also funneled through Applied Research Organisations (TO2) such as TNO.

Additional funding, venture and growth capital for startups and scaleups, is available through publicly funded private investment fund InvestNL. With AI is one of its focus areas (SAPAI, 2019), and so far, €5 million in venture capital has been invested in AI-driven enterprises (InvestNL, n.d.). Together with MinEZK, Invest-NL also launched a Deep Tech Fund that aims to invest in knowledge intensive start-ups and scaleups (InvestNL, n.d.).

Thus, AI investment often follows one of these routes, with each their specific focus: via NWO calls or SIA calls, via TO2 institute programmes and projects, via RVO or via

InvestNL. Through the more 'academic' route (NWO), AI investment is used in calls for fellowship grants to attract AI talent to the Netherlands. (see section 2.3.4). Through the more market-focused route of RVO and InvestNL, funding may reach innovators on the market in several ways, such as:

- Direct investment by InvestNL or one of its subsidiary investment funds such as the Deep Tech Fund
- Tax credit for R&D (WBSO), where individual entrepreneurs, start-ups or innovative SMEs may receive a tax credit benefit for development projects and technical-scientific research;
- SME innovation stimulation (MIT): intended to stimulate SMEs to contribute to the knowledge & innovation agendas through different instruments: R&D collaborative projects, feasibility studies, knowledge vouchers, network activities, innovation brokers;
- Small Business Innovation Research (SBIR), an innovation competition for entrepreneurs, where public sector organisations can act as launching customers

2.3.3 Nederlandse AI Coalitie (NL AIC)
The task of implementing some of the ambitions formulated in SAPAI was

organized as a bottom-up partnership, favouring a collaboration between government, industry, academia, and civil society (quadruple helix). The Netherlands AI Coalition (NL AIC) took on the challenge of rallying up and organizing the Dutch AI ecosystem, aiming to speed up AI developments in the Netherlands and to connect AI initiatives from government, business, education and knowledge institutes, and Non-Governmental Organisations (NGO). The NL AIC, like AINED in 2018, started as an informal group of industry representatives, academic institutions and institutes of applied scientific research, with additional support from the MinEZK.

The NL AIC started in 2019 with 65 member organisations (NL AI Coalitie, 2019) and has grown to 475 member organisations (NL AI Coalitie, 2022, October 12). Structured as a public-private partnership (PPP), the NL AIC is governed by a strategy team and a programme team, working groups and working group leaders, and regional AI hubs. Within vertical working groups (sectors) and horizontal working groups (building blocks) members collaborate, share knowledge and participate. NL AIC together with its member organisations define the main themes of their activities

(i.e. buildings blocks for AI, such as data sharing, trustworthy AI, human capital, etc.); as well as the sectors[5] of application (i.e. those likely to deliver maximum impact to benefit the Dutch economy and society). Furthermore, NL AIC also takes on a regional approach, expanding the ecosystem further to regional centres of AI expertise.

Preceding funding for the AiNed program, the MinEZK provided €23.5 million of kickstart funding over the period 2019 – 2022 to be used by NL AIC and its affiliates to start projects on the topics mentioned above and to organize the coalition and the hubs.

2.3.4 AiNed

AiNed, launched in 2021, is the strategic AI R&D&I investment programme of the Netherlands, which received a grant of the National Growth Fund (NGF). In 2019, the cabinet-Rutte IV announced the start of the NGF with the aim of investing € 20 billion in projects with the highest potential for structral and durable economic growth (Rijksoverheid, n.d.). This announcement coincided with the start of the NL AIC. As the goals of the NL AIC fitted well with the stated objectives of the NGF, it was

therefore clear to the members of the NL AIC that one of the strategic goals of the NL AIC was to submit a proposal to the NGF. In fact, MinEZK routed all requests from parties in the Netherlands that wanted to submit a NGF proposal focused on AI to the NL AIC. Therefore, the NL AIC became the central coordinating party to submit the AI proposal to the NGF.

Ultimately, AiNed received a grant of €276 million (€447 million including partner contributions) for a period of 7 years from the NGF; It was selected as one of the first projects to receive NGF funding in 2021. Even though the initial ideas within NL AIC had much larger ambitions to the tune of €1 billion investment from the NGF doubled by co-financing to a total budget of €2.1 billion, the award of the NGF gave a significant national stimulus on AI. One of the conditions of the NGF was that funding must be organised through an independent foundation which channels the funds through existing mechanisms such as the NWO and RVO. This foundation was set up end of 2021 named AiNed.

The desired impact of projects funded by AiNed is to strengthen the Netherlands' economic position, and to contribute to the

development of human-centred AI. Similar to the NL AIC, the so-called 'quadruple helix' is the favoured approach, meaning that projects should aim to involve representatives of four main categories of stakeholders: government, research, industry, and civil society (AiNed, 2022). In addition to projects aimed at developing and applying AI solutions, AiNed finances other types of activities, as well. AiNed has 4 subprogrammes:

1. Developing the AI innovation capacities of companies and governments through collaborations that span the value chain, but also by helping SMEs and start-ups specifically.
2. Strenghtening the knowledge- and innovation base by setting up innovation labs for business, public organisations and knowledge institutes, and Ethical-Legal-Social Aspect (ELSA) labs, attracting talent through fellowship grants, and endorsing European participation and mobility.
3. Supporting the acquisition and development of AI skills through practice-oriented AI education, accelerated through learning communities, and education vouchers for (re)training and certifying employees.

4. Facilitating collaboration among the different subprogrammes, AI hubs and the NL AIC, including European networks.

The AiNed programme uses several familiar instruments such as education vouchers or mobility grants, but also introduces several new instruments, such as ELSA Labs and chain projects. ELSA Labs are living labs or innovation labs where ethical, legal, and social aspects of AI are explored through experimental, iterative and incremental development in environments for collaboration and knowledge-sharing, aiming to accelerate responsible innovation. This enables "dynamic learning process that is essential for a rapidly developing technology such as AI" (Van Veenstra, Van Zoonen & Helberger, 2021, p.2). Its fundamental principles are: articulating missions using sustainable development goals and societal challenges in addition to human-centric AI systems; using design thinking approaches; working with quadruple helix consortia. Since its introduction in 2021, over 20 initiatives have been awarded the title of 'ELSA Lab' and AiNed plans to fund four more ELSA Labs in the next round of funding (AiNed, December 6, 2022). Chain projects are projects in which stakeholders

5. Currently, the selected sectors include among others: Culture & Media; Defence; Energy & Sustainability; Financial services; Built environment, Health; Education; Maritime, etc. The full list of NL AIC prioritized sectors can be found at: https://NLAIC.com/toepassingsgebied

across an entire value chain collaborate to achieve breakthroughs in AI technology, applications, services or products – achieving more structural change. The intended proof of concept chain projects are the energy system, personalised (preventive) care, and intelligent diagnostics (2023, February 28).

As a result of direction of the National Growth Fund Committee, AiNed focuses on a subset of sectors selected by NL AIC: Energy & sustainability; Healthcare; Mobility, transport and logistics; Technical industry. In addition, the programme prioritizes several AI focus areas: Embedded AI; Hybrid AI systems; AI-controlled and AI-managed infrastructure; AI for the Dutch language; Personalisation and privacy protection; Data sharing.

2.3.5 Other AI R&D&I programmes
The R&D&I infrastructure described in the previous paragraphs does not cover all AI-related activities in the Netherlands, nor does it aim to do so. Many such activities preceded it; others continue to emerge and function outside it. For the latter category, next to self-funded activities, there are various other channels and (policy) instruments available, aiming to encourage (adoption of) innovation. Most of them are generic, rather than AI-specific

(for example instruments used by the Netherlands Enterprise Agency (RVO) to help SMEs and start-ups). This section describes several other initiatives.

Innovation Centre for Artificial Intelligence (ICAI) and the ROBUST Long-term programme

The Innovation Centre for AI (ICAI) is a PPP aimed at knowledge and talent development in AI, initiated in 2018 by the University of Amsterdam and the Free University Amsterdam (ICAI, n.d.). ICAI emerged from the network built in earlier ICT-oriented PPPs COMMIT/ (2011) and COMMIT2DATA (2016) and was a consortium partner in the AINED report (see section 2.1) which led to the Netherlands AI strategy. ICAI has grown into a national network of knowledge institutions, industry, and government. The main instruments (building blocks) are labs, which are long-term collaborations between academia and large corporations ensuring a certain amount of PhD positions (e.g. Ahold Delhaize, Bosch, Qualcomm); AI courses for different audiences; organizing events throughout the community; joint appointment programme for academic staff; matchmaking between PhD students and Dutch companies; and AI knowledge-

based start-up program. As of 2022, ICAI established 31 AI labs (e.g. AI for FinTech lab, AI for Oncology lab) with 100 partners and over 160 PhD researchers (ICAI, 2023).

ICAI received € 25 million funding from NWO for a long-term programme of research-industry collaborations on robustness in AI. (NWO, n.d.) This national programme, 'ROBUST – Trustworthy AI-based Systems for Sustainable Growth' (2023-2033), has a total budget of € 87 million and is carried out by a consortium of universities, knowledge institutions, companies and civil society. They aim to realise breakthroughs in five core dimensions of robust artificial intelligence (AI): accuracy, reliability, repeatability, resilience, and safety. The ROBUST programme intends to produce 17 new public-private AI labs and employ 170 PhD researchers.

Appl.AI

TNO started the Appl.AI programme in 2019. The Appl.AI programme runs from 2019 to 2026 with a total funding of € 65 million brought together in the combination of TNO funding plus co-financing from partners. The aim of the programme is to connect fundamental AI research with applied research

and innovations. There are three core AI roadmaps in the programme on autonomous systems, trustworthy decision support and life cycle management. On these topics, research roadmaps build on the state of the art and apply them in real life settings. Together with co-financing partners, this research is than applied to a specific use case.

National, university-driven and industry-driven AI research programmes

Besides ICAI and Appl.AI, several other initiatives emerged. These are national research programmes on AI, university and knowledge institute programmes on AI, and broader programmes with implications for AI research.

First, several national research programmes on AI have been initiated. One example is VWData: Responsible value creation with Big Data (2017-2021), funded by NWO under the NWA; Efficient Deep Learning (2018-2022), funded by NWO through a programme for new lines of applied science. The aim is to make deep learning much more efficient and transparent on the basis of use cases from daily life. The consortium of VWData

consists of seven universities and 35 Dutch companies (EDL, n.d.). Another example is Hybrid Intelligence (2019-2029), a project that aims to design human-centered AI systems. The interdisciplinary research consortium consists of six universities and one applied research institute, receiving €19 million funding over 10 years directly from the Dutch Ministry of Education, Culture and Science (MinOCW), aimed to stimulate excellent research with the potential to become world leading.

Universities and industry are also investing in AI R&D&I programmes. Examples of programmes include: AI Labs & Talent Programme which sets up 24 labs for interdisciplinary AI research every five years, funded by the Delft University of Technology for €6 million per year (TU Delft, n.d.). Another example is AiPact, a society-centered interdisciplinary research and education programme at the Erasmus University of Rotterdam (EUR, n.d.) based on arts and culture, communication and change, healthcare, work and labour. Yet another example is Kickstart AI, a

strategic partnership between several large corporations from the Netherlands aiming to promote AI education, talent and innovation (NS, 2019, October 10).

R&D&I programmes with important AI component

Other policies and programmes also affect AI R&D&I, such as industrial transformation and big data. Smart Industry, the Netherlands' industry 4.0-programme, considers AI as an important key enabling technology (Smart Industry, 2022). In the mission-oriented innovation policy, AI is well represented in the Key Enabling Technologies agenda for 2020-2023 (TKI HTSM, 2019) and the National Technology Strategy (Rijksoverheid, 2023, May 25). Another example in the same category is Commit2Data (2017), a national PPP funded under the top sector policy, which brought more than 100 companies and knowledge institutes together on big data research, valorisation and dissemination.

3 Case study of the national PPP (NL AIC) and strategic investment programme (AiNed)

To understand what impact was expected, what impact has actually been achieved, and what can be learned from the Netherlands AI strategy and its implementation, we conducted a case study within the national AI strategy. This case study was focused on the AI strategy SAPAI (described in section 2.2), the public-private partnership NL AIC (described in section 2.3.3) and the strategic investment programme, AiNed (described in section 2.3.4). Section 3.1 describes our method and data, and section 3.2 presents the results of the analysis.

3.1 Method and data collection
We conducted in-depth interviews with 9 key stakeholders, selected because of their direct involvement in the establishment of the AI strategy, AiNed and the NL AIC. The results were verified during a workshop organised on May 8, 2023, to which all interviewees were invited. See Appendix A.

Each in-depth interview took approximately 60 minutes and was conducted by the first and second author, and notes were taken. The format of the in-depth interview was semi-structured: after an introduction of the topic and purpose of the study, participants were asked open-ended questions about how they experienced the original aims and priorities of the Dutch AI strategy, the

process, sectoral and technological focus, impact and measurement, and lessons learned. Thematic analysis, a method to discovering patterns of meaning ('themes') in qualitative data (Braun & Clarke, 2008), was used to analyse the interview notes and to find aggregate themes in the diverse set of experiences from stakeholders. Sentiments identified in the interview notes by applying a thematic analysis were aggregated at sentence level and each group was given a representative sentence name. A second aggregation resulted in 6 main themes, which are reported in section 3.2.

3.2 Results
Thematic analysis of the interviews resulted in the discovery of six **themes in the attitudes of interviewees towards the Netherlands AI strategy** process and results:
1. The role of the government in the emergence of the AI strategy
2. The use of existing (policy) instruments
3. Stakeholder involvement and participation
4. Combining multipe AI-initiatives in a single strategic investment program
5. The implementation shifting towards fundamental research
6. Alignment with Europe and EU Member States

As mentioned above, these are the findings of the qualitative analysis of in-depth interviews conducted with key actors. They describe the broad spectrum of opinions and viewpoints held by key individuals directly inovlved in the setting up of the Netherlands AI strategy. The following subsections further elaborate on the six themes identified in the interviews.

3.2.1 The role of the government in the emergence of the AI strategy
Interviewees broadly agreed on the opinion that initial conditions for the Netherlands were favourable, from which the AI strategy emerged, but that the financing of AiNed took a relatively long time. With regard to the role of the government, the opinions of the interviewees were split: while some considered the government too hands-off, others considered the role of governmental stakeholders to have been vital in the case of the NL AIC and AiNed. This section further describes the views on the role of the national government.

The Netherlands had favourable initial conditions, from which the AI strategy emerged

Prior to 2018, the Netherlands was in a favourable starting position and already actively involved in AI research and

development (see figure 3.1). However, there were no dedicated AI institutes like the German Deutsches Forschungszentrum für Künstliche Intelligenz (DFKI) which was founded in 1988. Large corporations like Philips were also becoming less involved in setting up national strategies than had been the case in the decades before, which is in line with a general withdrawal of large corporations from more long-term research activities.

Pre-dating AiNed and SAPAI, several individuals active in the Dutch AI and in the ICT innovation fields (see section 2.1), saw countries inside and outside Europe actively defining their own national AI strategies and allocating significant budgets to AI. This group felt that action had to be taken. With the aid of the MinEZK, this group produced the 'AI voor Nederland' (AINED, 2018) report within a period of weeks in 2018. The report concluded that the Netherlands had a strong knowledge base, but that the link with the private sector – in particular with innovative SMEs – was deficient. It followed that, according to the report, a national Public-Private Partnership (PPP) for AI would be necessary to bridge this gap (AINED, 2018). Furthermore, AINED concluded that specific topics warranted a national approach such as developments on human-centered AI, education in AI and the development of data sharing.
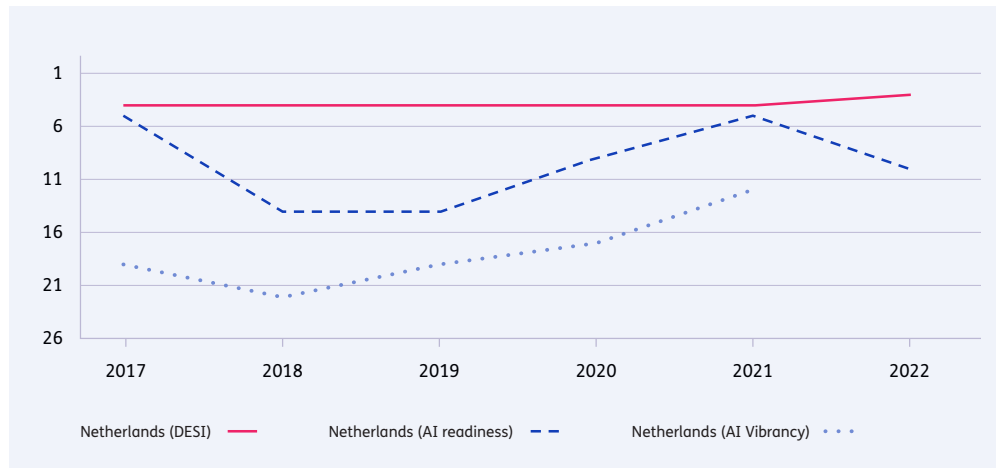
Figure 3.1. From a relatively favourable starting position, the Netherlands has risen in the international benchmarks DESI, AI Governmental readiness index and AI Vibrancy Index. See Appendix B. for the data and more detailed explanations. (Source: Authors' elaboration based on data from the European Commission, Oxford Insights and Stanford University)

It took a relatively long time to set up an AI R&D&I investment programme after the AINED report

The AINED report of 2018 inspired the government to draft a national AI strategy (SAPAI) and to support the formation of an AI PPP (NLAIC). In July 2019 the MinEZK initiated a Taskforce AI under Kees van der Klauw (one of the interviewees), which ultimately led to the formation of the NL AIC. In October 2019, the Dutch government published SAPAI.

Looking back, most of the interviewees feel that the process from knowing what was needed from the first AINED report to the implementation of the AI R&D&I investment programme took relatively long. The process to build a national coalition and agree on a strategy, coupled with a new instrument (the NGF) and the subsequent funding mechanisms meant that the community involved had to patiently wait for these steps to play out. Thus, counting from the initial AINED proposal (October 2018) to the actual funding of projects with the NGF grant (March 2022), more than 3 years were

needed, and for some topics calls still have to start. This period was bridged with so-called kick-start funding of €23.5 million provided by the MinEZK over the period 2019 – 2022. This helped, although it could not satisfy the full scope and ambition of the plans of AINED and the NL AIC.

Thus, as pointed out in the interviews, the coalition approach, leading to the opportunity to have all relevant parties involved also brought the risk that it is difficult to keep people interested long enough and to create and keep momentum for the idea backed up by significant funding.

Some considered the government too hands-off

The perceived relationship between the national government and digital technology was also highlighted during the interviews. Several experts interviewed expressed the opinion that the national government has been too hesitant regarding digital technology in general, not realising how impactful digitalisation will be. They pointed out the relatively late appointment of the first Dutch State Secretary of Digital Affairs (2022), in comparison to other EU Member States and the EU – which already had a (Dutch)

commissioner for the digital agenda in 2010. AI is not an isolated case and government in general seem to struggle with ICT, for instance legacy systems used by the Dutch Tax Authority (Nu.nl, 2023, March 4).

In relation to the AI policy, the government was perceived by most of the interviewees as 'hands-off'. First, it took the Dutch government quite some time in comparison with other countries to set a national strategy. Second, SAPAI was seen as not very useful in terms of impact measurement and KPIs and more a stocktaking of existing projects than a new AI agenda. Third, responses to the WRR report were also delayed (11 months until cabinet response, 14 months until the parliamentary debate) and discussions within the government were regarded as mostly defensive. An interviewee remarked that "the Netherlands acts a trading nation": if there is no money to be made in the short term investments will fall short. By means of comparison, the interviewee referred to Germany, as an example of systematic investment in technology development.

The interviewees suggested that the preferred role of the Netherlands government would be to take action in case of market failure and to support

valuable initiatives. Policy support could provide necessary resources, infrastructure, etc. to contribute to the success of these initiatives. In this role, a flexible, learning approach would be essential and allowing for and embracing failure would be needed in AI innovation.

Support, consistency and kickstart capital were key for the NL AIC

Despite the remarks detailed in the section above, there was also recognition for the role that the MinEZK played. The MinEZK provided substantial support to AiNed, and specifically the Directorate-General Business & Innovation gave direction while also maintaining a suitable distance. The kickstart-funding of €23.5 million from the MinEZK was a crucial factor in the build-up of the NL AIC which allowed the community to work on some key projects which bridged the gap until the National Growth Fund finances were in place.

The creation of the NL AIC and later on AiNed focused efforts and created as certain level of consistency in approach and choice of topics. A coalition will not always lead to results the members want. As one interviewee remarked, a transition can be seen as an S-curve where a

continued effort is necessary until a self-sustaining organisation is in place.

SAPAI is considered a policy milestone, but not a strong vision for the future

SAPAI, written in response to the call-to-action of the AINED report, was meant as a policy milestone by which AI strategies and actions could be tuned between ministries. SAPAI was the result of an inventarisation across various Dutch ministries and gave an overview of AI action plans and announced additional funding.

The result of SAPAI and follow-up actions have been fairly unclear to most interviewees and the effectiveness of SAPAI reaching its intended impact is also questioned, especially given the large investments in AI elsewhere. Specifically the topics of AI talent and AI entrepreneurship are mentioned as falling short. Generating sufficient AI talent in a policy document may be a good start, but not if universities are limiting the number of AI-students which is not adressed. Besides new AI talent, more attention is also needed for investing in retraining.

Interviewees also mentioned other issues having to do with the technology itself.

First, since AI is so broadly applied, too many (conflicting) interests are at play which makes it difficult to direct resources Second, AI is a technology that presents a broad list of technologies and hence functionalities. The WRR refers in this respect to AI as a systems technology which sets it apart from other types of ICT innovation (Wetenschappelijke Raad voor het Regeringsbeleid, 2021). This wide scope makes it difficult to identify where a real difference can be made because of a national strategy.

Finally, there seems to be a mismatch between expectations by some of SAPAI and what its authors intended. While it is argued that SAPAI was merely created to provide a snapshot and that new policies have been put in place, such as the Working Agenda Value-driven Digitalisation (Ministry of the Interior and Kingdom Relations, 2022) and the Strategy Digital Economy (Ministry of Economic Affairs and Climate Policy, 2022), others felt that a vision and executable strategy on AI are lacking.

3.2.2 The use of existing (policy) instruments and structures
The AI strategy as detailed in SAPAI and the AiNed programme is perceived as less mission-oriented than, for instance, other innovation policies. The suitability

of existing policy instruments and ways of monitoring and evaluation is questioned, and seen as not fit for the purposes as described in first and foremost the AINED report. This section further describes the views on the use of existing instruments for the AI strategy implementation.

The Netherlands is an early adopter of mission-oriented research and innovation policy, although this has not yet persisted into the AI strategy

In the Netherlands, research and innovation policy are focused on addressing broad societal goals or grand challenges. As such, the Dutch Research Agenda (NWA) has been developed which defines so-called 'routes' of research, rather than areas of research, to address scientific, societal and economical challenges (NWO, 2018). Similarly, innovation policy has adopted a mission-driven approach as of 2019. These missions are aligned with international priorities such as the Sustainable Development Goals and Horizon Europe (Ministry of Economic Affairs and Climate Policy, 2021).

It is felt by interviewees that the AI

strategy as described in AiNed does not embrace an innovation systems (or transformative innovation policy) approach as outlined in the previous paragraph. They expressed that it should not just be about AI development, but about transitions. As an example, the essential role of AI in the energy transition is highlighted.

Another point made by interviewees is the importance of ecosystems. To achieve a successful transformation, orchestration of the ecosystem is seen as an all-encompassing approach to AI. This might require other instruments than currently available and deployed.

Deployment of current (top sector) policy instruments for the AI policy may not be fit for purpose

In setting up and implementing the Netherlands AI strategy, the MinEZK, as well as AiNed benefited from existing innovation 'best practices' and innovation policy instruments of the previous decade. (Ministry of Economic Affairs and Climate Policy, 2021). However, according to the interviewees, a re-evaluation of the policy instruments might be necessary so as to take into account the specific needs of the

AI strategy and its implementation. Two new developments are mentioned by the interviewees:

- The tendency of ministries to invest in innovation programmes themselves, besideds the centralise innovation policy through MinEZK and MinOCW, so as to have more control on innovation (e.g. ELSA Lab Defence). The introduction of more governmental stakeholders may impact AI R&D&I policies and programmes.
- AiNed is funded by the National Growth Fund but that policy is different from the top sector policy. This may alter how AI R&D&I policies and programmes are evaluated.

New ways for monitoring and impact measurement need to be considered

Several interviewees mentioned the importance of monitoring the deployment of the Dutch national AI strategy, and defining suitable key performance indicators (KPIs) to measure its outcomes and impact. Existing EU indexes (e.g. Digital Compass, DESI index) while useful, were considered insufficiently specific. The interviewees also noted the absence of (information about) initiatives at EU Member State level

to monitor and measure the performace of their AI strategies.

The interviewees suggested that NWO/RVO adapted the monitoring of impact of their respective funding structures. For example, calls for funding through NWO could require criteria and boundary conditions to increase the uptake of AI (e.g. requiring Service Level Agreements with executive organisations). More recently, and for funding via the Netherlands Growth Fund, a number of impact indicators have been defined and are currently being tested. An interviewee suggested a number of KPIs that could be used to measure the success of AI R&D&I (ex ante), for example: whether there is a right to play (understanding the problem) and right to win (access, talent, technology). Trust and track record were also mentioned as elements essential for AI R&D&I.

3.2.3 Stakeholder involvement and participation

Stakeholder invovlement is a key theme in the Netherlands AI strategy, which strives for an inclusive, quadruple helix collaboration. However, even though the NL AIC includes civil society and start-up representatives, they find it hard to participate. The result of the stakeholder involvement approach is that many sectoral and regional interests must be

integrated in the NL AIC, which then becomes a balancing act between inclusion and the need to target the investments. This section further describes the views on stakeholder involvement.

The NL AIC aims to actively involve societal actors and pursues an inclusive, quadruple helix collaboration

The NL AIC maintains a quadruple helix approach to innovation, referring to the involvement of four main groups of stakeholders: industry, government, academia, and civil society. The current strategy and participation of a large number of diverse organisations is seen as evidence that the quadruple helix principle works. Over the course of a few years, the NL AIC grew from 65 to 475 member organisations (NL AI Coalitie, 2022, October 12).

Some efforts specifically target civil society and start-ups. Civil society (i.e. NGOs) bring a different and unique voice to the discussion. Ministries and PPPs want to help them overcome barriers to an active involvement in the application of AI. Participation in the NL AIC is supported by lower costs for start-ups and NGOs. For

start-ups, the NL AIC provides an attractive networking place for finding clients and partners. It is valuable to showcase their solutions in practice. Some interest groups and regulators keep a distance to maintain an independent position, and hence do not join the NL AIC. Concluding, there is a large variety of participants in the NL AIC, although that does not mean that the level of participation is equal.

Barriers to civil society participation are procedures, limited funding and limited technological knowledge

According to the interviewees, many NGOs struggle with a technological knowledge gap and little professional in-house capabilities – some organisations even depend fully on voluntary contributions. A topic such as AI would be hard for these organisations to engage in, in a meaningful way.

Standardization committee participation costs are too high for NGOs and, while one goal is achieving 'AI wisdom in society' (Wetenschappelijke Raad voor het Regeringsbeleid, 2021, p.13), there is still a lack of knowledge and trainings so that civil society can join a meaningful

debate on AI (e.g. courses that are aimed at health care providers but not patient representatives). So even though the goal of civil society participation is well understood, in practice it is hard to realise.

One practical problem for civil society participation was highlighted during one of the interviews: NGOs are not allowed to lead ELSA Lab proposals (dutch: 'penvoerder') and therefore can only be in a position of partner of academia. Thus, they must bet on multiple horses by participating in European lobby organisations, standardisation bodies, work with other ministries, and other PPPs.

Barriers to start-up participation are bureaucracy and competition

According to the interviewees, start-ups in the NL AIC benefit from participation in concrete initiatives and in networking with potential customers. However, participation is not always easy or a given. Setting up collaborations between different categories of participants (corporates, start-ups, academia) can take a relative long time, especially from the point of view of start-ups. Acquiring access to available funding can be bureaucratic and time-consuming, and thus less feasible for start-

ups. Participation in EU-funded research programmes such as Horizon Europe are also less interesting for start-ups because of the substantial investment required in terms of time and internal resources. Government tenders, too might be less feasible because of strict (procedural) requirements. The interviewees assessment was that the MinEZK, the MinBZK, NL AIC, and AiNed together are in a position to address these barriers, so as to improve participation of start-ups.

In general terms, participation in projects in the realm of the NL AIC means bureaucratic and long term processes which are a challenge for start-ups and larger corporates alike. Interviewees mentioned the potential of instruments to which large corporations can bind themselves to AiNed for longer term (four years was mentioned) and where small or medium enterprises can join for a shorter time span.

Another barrier for start-ups is competition. First, it is hard for (early stage) start-ups to attract talent, as they compete with corporates that offer much higher salaries. They must compensate by offering options and stocks. The risk is that start-ups are not able to make their value proposition come to fruition, potentially impacting tech transfer and valorisation. Second,

start-ups may also experience competition with Applied Research Institutes (TO2) and spin-offs from universities. As it is easy for start-ups – AI start-ups in particular – to get investors from other countries, the risk is that they leave.

The NL AIC governance structure evolves to improve bringing together diverset interests, sectors and regional hubs

The NL AIC emerged as it integrated many different AI strategy efforts that already existed, growing within a year from 65 to more than 250 members (NL AI Coalitie, 2020, February 11). It was meant as a connection between society and not a lobby group for one point of view. In the design of the NL AIC, a choice was made to organise along the lines of sectors, building blocks and hubs. Some interviewees felt that the resulting organisation of the NL AIC is overly complex and unclear in its governance.

A benefit of the sectoral approach is that members who speak the 'language' of the sector are connecting to AI knowledge. The WRR report made clear that AI will transform all sectors, but concluded that

is important to choose which ones the Netherlands want to excel at to be able to direct investments. This has been an ongoing challenge for the NL AIC: From the outset, inclusion of all sectors that wanted to join was built in. At the same time, for instance in the AiNed proposal to the NGF, the NL AIC was forced to focus on a number of priority sectors. This balance between inclusion and focus let to serious discussions within the Program Team of sectors that were not prioritized as a result of the guidance of NGF.

A benefit of the 'provincial hub'-structure is that they can speak on behalf of regional industry and can reach many AI companies in their respective geographical area. These regional networks of companies supported by knowledge institutes are important to the economic agenda. The Brightlands ecosystem is an example of such a regional hub.

3.2.4 Combining multiple AI-initiatives in a single strategic investment programme

Many different initiatives with different 'rhythms' needed to contribute to the AiNed, which is a long-term programme. This section further describes the views on the national AI investment programme.

The AiNed proposal was a collaborative effort integrating many different agendas and 'rhythms'

Similar to the NL AIC, AiNed also represented a selective group of stakeholders in the AI R&D&I domain. During the drafting of a proposal for strategic AI R&D&I investment program, to be submitted to the National Growth Fund, the MinEZK required all parties and consortia that wished to come with AI growth fund proposal, to join the AiNed proposal. Thus, writing the AiNed proposal became a very large collaboration. As a result, a challenge was to bring together the different 'rhythms' of businesses, academia and government in these collaborations. The AiNed proposal itself outlines a programme that offers structure to finance individual projects and programmes. While the funding for AiNed is substantial, it is less than desired, as the proposal initially aimed for € 1 billion in funding.

The process of drafting a research and innovation agenda is a rather difficult process and understanding how the system works is felt to be for insiders who have gone through these processes.

Even for skilled researchers, used to these processes, it was considered difficult to collaborate, as many push their own agenda. One issue identified by the interviewees is that parties - both scientists and businesses –sit at the NL AIC table and make promises, but once the funds have been allocated 'take the money and run'. The risk is that AI R&D&I will eventually break down into individual projects that do not add value compared to a coherent national AI program, but with more overhead.

3.2.5 The implementation shifting towards fundamental research

In the Netherlands AI strategy there is much attention for the application of AI, often in the form of 'labs'. The AI strategy aims for AI applications, e.g. through VNO-NCW involving large corporations. Although that is not at odds with fundamental research, which is funded through universities and NWO grants and can also produce new applications, it does mean a narrower scope for the AI strategy. Given that context, interviewees report that there has been a shift in the focus from tech transfer and innovation to fundamental research. This section further describes the views on a shift towards fundamental research.

Labs are a popular collaboration format between industry and (applied) research organisations

An emerging trend in the Netherlands is to organize R&D&I projects and facilities as labs ('proeftuin') – fieldlabs, living labs, innovation labs, or testing grounds such as ELSA Labs. This model is heavily used in the national AI programmes and other relevant activities (e.g. ICAI, TU Delft, Erasmus University). Although all 'labs' function according to different principles, they all share some characteristics: they bring together multiple categories of stakeholders, shared facilities; experimental, iterative and incremental development; and focus on speeding up innovation by developing new services and products and bringing technologies to higher TRLs (ZorgTech, 2019). Universities in particular are very active organisers of AI labs in which they cooperate with the private sector.

One advantage mentioned was that the ELSA lab helps policy makers to guide technology development instead of coming up with rules to limit the use of AI. For instance, if many accidents happen at a 4-way junction, instead of introducing speed limits or overtaking

bans, building a viaduct may be a better solution. In addition, ELSA Labs focus on a specific application area with relevant stakeholders. It is from these application areas that human-centered AI business cases arise. This results in a 'market pull' rather than 'tech push' dynamic.

The implementation shifted more to fundamental research than application of research, producing a disbalance

An often remarked issue is that – while the stated AI strategy aims for the application of AI – the implementation of the strategy has shifted towards fundamental research. There is not one major explanation for this phenomenon, as the shift or disbalance rather emerges from several contributions, among which:

- AiNed had the assignment to build an AI knowledge base before looking for other initiatives. Initially AiNed proposed six value chain projects (high TRL projects with partners across an entire value chain), but this was reduced to only one at the request of the NGF evaluators. The motivation from the NGF evaluators was that the value chain projects are a new mechanism. It first needs to prove

itself before multiple projects can start.
- AiNed mainly collaborates with NWO to fund projects, which both have different goals in relation to R&D&I (Figure 3.2). This is further explored in subsection The funding instruments of NWO or RVO used by AiNed may not be fit for purpose'.
- NGOs are not allowed to lead (Dutch: 'penvoerder') ELSA Lab proposals and therefore are put in a position as partner of academia, and so fundamental research may play a more important role than application.
- It is difficult to obtain funding with a proposal that reserves budget to find interesting application areas. A funding agency may see that as 'unallocated funds' and decide to not fund.

The funding instruments of NWO or RVO used by AiNed may not be fit for purpose

AiNed has emerged in a complex existing structure (Figure 3.3). In general, it is felt that new types of innovations in line with the AiNed agenda are difficult to realise under existing funding structures as currently run by RVO or NWO For AiNed, NWO and RVO calls are currently the main instruments to fund projects. With NWO 'excellent science' is still the
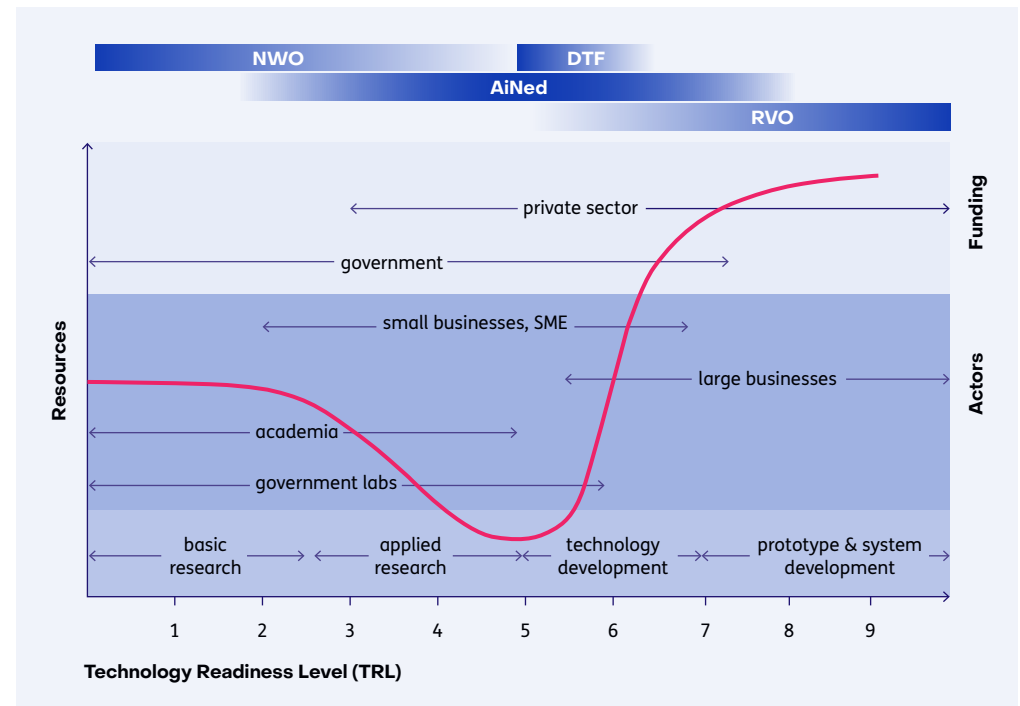
Figure 3.2. A focus on application of AI in the Netherlands AI R&D&I programmes has the benefit of reducing the gap between academia (e.g. funded by NWO) and industry (e.g. funded by Deep Tech Fund, RVO). This lack of available resources between research and development is shown as a red line 'dipping' around TRL 5) is called the 'valley of death' (Assink, 2006). (Source: Adapted from Hensen et al. (2015)).

primary norm, which is a different primary objective with the need for valorisation and impact. Interviewees also mentioned that RVO cannot always accomodate the wishes of AiNed. Moreover, AI programmes should have some flexibility that allows for experimentation and learning.

However, that is impossible when a multitude of organizations is each trying to carve a space in the AI space, creating fragmentation. With innovative projects it is important to experiment, learn and potentially deviate from the original plan.
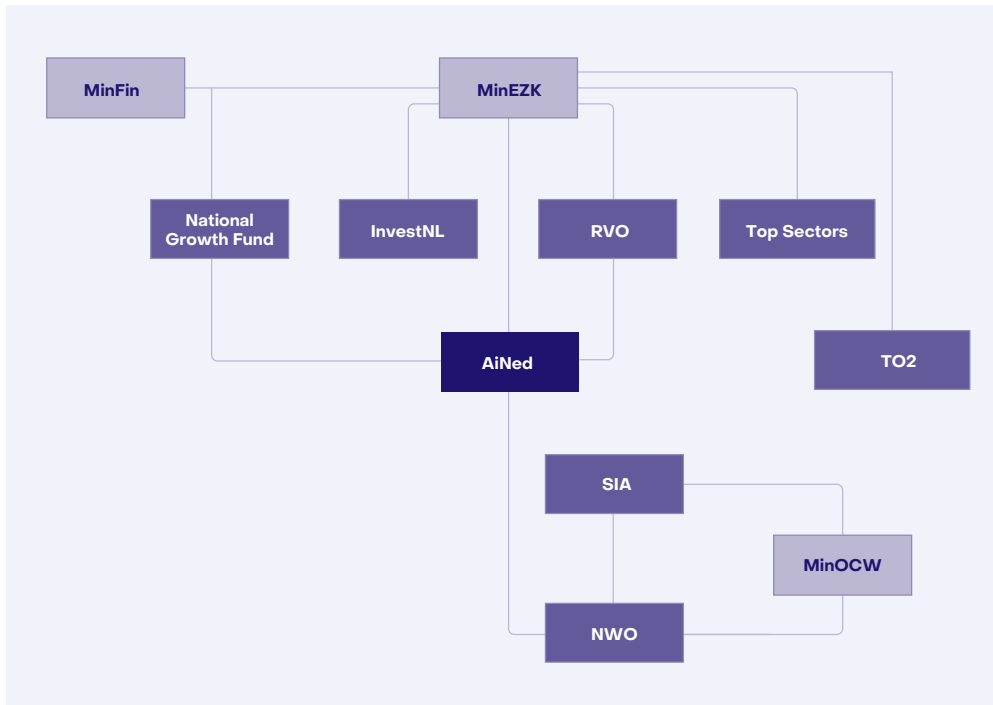
Figure 3.3. The existing R&D&I investment landscape in which the AiNed strategic investment programme has arisen is complex, consisting of the MinEZK, MinOCW and MinFin, NWO and SIA (including their Dutch Research Agenda and AIREA-NL), TO2 institutes, RVO, the Top Sector organisations, and InvestNL. The connections indicate ties between organizations, such as funding, partners or subsidiaries (Source: Author's own).

Learning processes and regular strategic reflections may reduce this shift

Interviewees felt that regular strategic reflections are needed with feedback from operations to strategy. It is important to learn from the individual innovations as a continuous process, through mehcanisms that allow for updating the strategy. The option was mentioned to update the AI strategy at least every 2 years.

3.2.6 Alignment with Europe and EU Member States

The Netherlands AI strategy is considered in alignment with the ambitions and values of the European Union – which is recognized as a powerful institution. EU Member States are often seen as partners and in some aspects they may be competitors. This section further describes the views on Europe.

Netherlands strategic goals align with European ambitions, although with different tactics

The Netherlands is ambitious in relation to its place in Europe, aiming "to become leading in AI research & innovation, and digital and intelligent connectivity and computing power for effective

AI-applications" (SAPAI, 2019, p.27). Interviewees feel that the Netherlands is well-aligned with European ambitions of human-centric and ethical AI. This is indicated by the high level of scientific research on social aspects of AI, further explored in ELSA Labs.

However, in the strategy implementation there is a tactical and operational deviation. For instance, while the Netherlands supported the 'coordinated action plan on AI' (European Commission, 2018), Dutch policy focused not so much on developing specific 'high-end competence centres', but to strengthen AI competence across the entire country – the organisations in the Netherlands acting as an AI innovation hub coordinated through AiNed and the NL AIC network – with the risk of spreading the investments too thin by allocating budgets to all.

EU Member States are viewed as valuable partners and potential competitors

Collaboration with other countries (in particular European Member States) is explicitly referred to as an important component to the Netherlands AI strategy (SAPAI, 2019, p.61). Besides the geopolitical rationale of European

collaboration in response to the United States and China – the 'AI arms race' narrative (Wetenschappelijke Raad voor het Regeringsbeleid, 2021) – European collaboration as a goal in itself is also appreciated. While bilateral collaborations require investments in time and resources, they are considered an effective strategy for playing a leading role in some AI areas (e.g. Human-centric AI).

One of the ways in which European collaboration is pursued is through membership of European initiatives, such as the BDVA or Adra, and participation in Horizon 2020 and Horizon Europe projects. Moreover, connecting to Europe is useful for sharing best practices and insights among countries. A barrier to collaboration is that the European AI landscape is considered complex and hard to oversee, which makes it difficult to choose which networks to contribute to – given limited capacity. There is need of a strong network where researchers and companies can find each other and collaborate.

Member States are sometimes viewed as competition as well as partners. For instance, when attracting talent such as professors, Member States are fishing in the same pond. It is suggested that the main 'competitors' are Germany and France. In the beginning it was difficult to keep AI experts in the Netherlands, who went to countries like Finland, although it now seems to be a more balanced situation.

The EU is recognized as an influential but complex 'shaper' through strategy and legislation

The EU has a strong influence in the AI agenda by its scale and through the positioning of certain topics such as human centered AI, regulation like the AI act and funding of programmes such as Digital Europe. However, while the EU is strong in regulating AI, European R&D&I seems fragmented still, which is difficult to overcome. In many ways, it reflects the same difficult choice that the Netherlands has in choosing focus over inclusion.

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5. Currently, the selected sectors include among others: Culture & Media; Defence; Energy & Sustainability; Financial services; Built environment, Health; Education; Maritime, etc. The full list of NL AIC prioritized sectors can be found at: https://NLAIC.com/toepassingsgebied

4 Comparison to AI strategies of Finland and Sweden

This section summarizes the two other reports drafted as part of this collaborative study: Section 4.1 describes the national AI strategy of Finland (Ailisto et al., 2023) and Section 4.2 describes the national AI strategy of Sweden (Burden et al., 2023). Section 4.3 presents a brief comparison between the three AI strategies. The summaries in Section 4.1 (Finland) and in Section 4.2 (Sweden) have been authored and provided by VTT and RISE respectively and have been included with minimal changes.

4.1 Finland[6]

Artificial intelligence entered the Finnish national agenda in 2017, when PM Juha Sipilä's government launched the national AI strategy programme "Tekoälyaika" (Ministry of Economic Affairs and Employment of Finland, 2017). The goal of the programme was to ensure that Finland becomes one of the frontrunners among countries that apply AI. Three important areas were identified: 1) ensuring that companies receive adequate support for the development of AI-based innovations, 2) facilitating the secondary use of public data as an essential enabler of AI, and 3) preparing society for the AI age and anticipating the changes brought about by AI. The next Finnish government led by PM

Sanna Marin set up a similar programme AI 4.0 (Ministry of Economic Affairs and Employment of Finland, 2020). The name of the programme combined AI and Industry 4.0, and it identified "objectives and measures that will promote digitalization in Finland. The programme focused on the development and introduction of artificial intelligence and other digital technologies in companies." Furthermore, the programme was intended to support the EU goal of double transition (i.e. green and digital). The strategy programmes were mostly high-level, and their impact was indirec. For example they did not contain specific budget allocations for R&D&I programmes or guidelines for AI adoption in the public sector.

Under the national strategy programmes, R&D&I programmes with substantial resources were launched by government agency Business Finland (total budget including company investment was € 235 million between 2018 – 2021. The programme supported companies aiming at growth and internationalization, i.e., increasing their export as well as research parties collaborating with such companies. In total 347 projects were awarded grants, which were available to individual companies and consortia. The average

project size was € 677 thousand (Keski-Äijö and Reponen, 2022). According to Business Finland, the programme more than doubled the exports and personnel in Finnish companies which received funding for developing AI based solutions (2.5-fold increase of exports to € 280 million by the end of 2020). In addition, Business Finland says that digital B2B services have become a strong area in Finnish exports, partly due to the programme.

The Academy of Finland funds the flagship Finnish Center for AI with € 16 million over an eight-year period. The flagship is a centre of excellence and impact ecosystem run by Aalto and Helsinki universities and VTT. The ecosystem includes some 20 industrial partners. Furthermore, the Academy of Finland has funded basic research on AI with more than € 10 million per annum in different programmes and so-called free calls.

Other initiatives worth mentioning are the Finnish AI Accelerator for introducing AI to companies and Aurora AI, a broad initiative for the public sector, which did not quite achieve its ambitious goals. A simplified schematic of the Finnish AI landscape with instruments and actors is presented in Figure 4.1.

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6. Summary authored and provided to be included in this report by VTT and is also found in Burden, H., Stenberg, S., Bodea, G., van Ette, F., Lazo, C.B., & Ailisto, H. (2023). A Comparison of AI Policies and Programmes in Finland, the Netherlands and Sweden – Case Sweden. RISE.
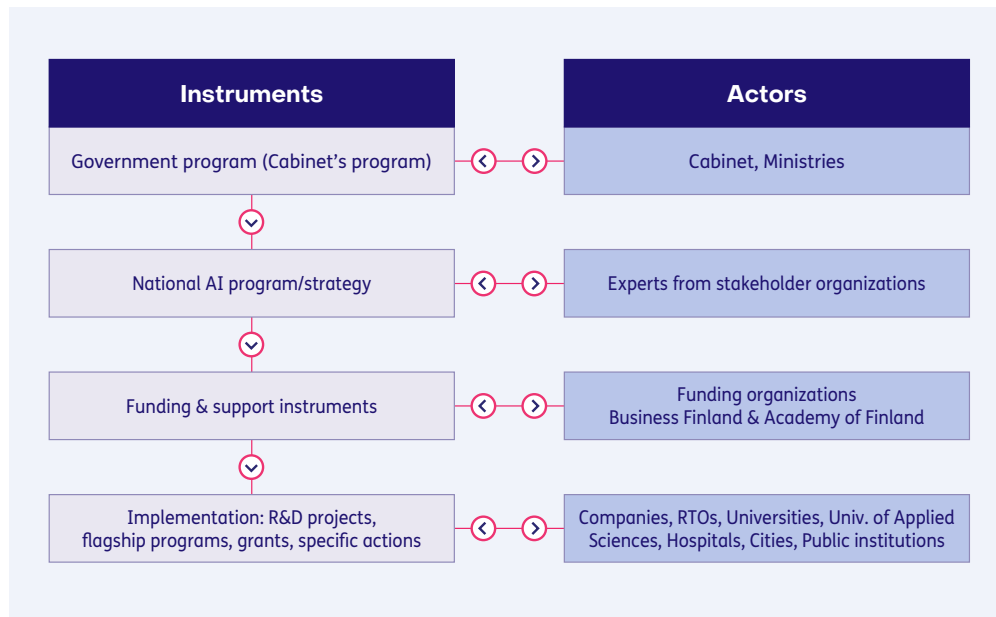
Instruments		Actors
Government program (Cabinet's program)	⟨ ⟩	Cabinet, Ministries
National AI program/strategy	⟨ ⟩	Experts from stakeholder organizations
Funding & support instruments	⟨ ⟩	Funding organizations Business Finland & Academy of Finland
Implementation: R&D projects, flagship programs, grants, specific actions	⟨ ⟩	Companies, RTOs, Universities, Univ. of Applied Sciences, Hospitals, Cities, Public institutions

Figure 4.1. Schematic of instruments and actors in the Finnish AI landscape.
Source: Reprinted from Ailisto et al. (2022)

The national policies and programmes have had an indirect impact by raising AI to the agenda of decision makers and public discussion. The use of AI solutions in private companies has increased remarkably since 2017, although this is not necessarily the result of the national policies or programmes. However, the direct impact of the programmes appears to be somewhat limited since the programmes did not have the mandate or resources to enact their recommendations. Implementation and follow-up mechanisms were lacking. Because of this, some rather obvious opportunities were not used, for example, committing public administration and public healthcare to prepare and deploy interoperable processes, practices, and tools to exploit AI technology.

Finnish AI research is of high quality, when comparing with the size of the population. However, there seems to be some gap between industry and research and thus the impact on business and economy is less than it could be.

The Finnish approach seems to have been more centralized than that of some other countries. That gives advantage in speed and agility, but on other hand, the approach is less inclusive regarding SMEs and civil society. Another aspect, where Finland could improve, is the uptake of digitalization and AI in the public sector. For example, the social and healthcare system, which is mainly public but regionally organized, could benefit from tighter collaboration and guidelines given by the government.

4.2 Sweden[7]
The Swedish government released an AI policy statement in 2018 (Ministry of Enterprise and Innovation, 2018). The statement was non-binding and came without specific resources or governance structures, akin to Finland. The overall ambition was to orchestrate existing initiatives for Sweden to become world-leading in AI uptake. In short, the ambition was excellence in utilizing the benefits of AI and not necessarily research into AI as a technology.

Different universities and the Wallenberg foundation's AI, Autonomous Systems and Software (WASP) programme, with a committed budget of SEK 5.5 billion (€ 500 million) for a period of 15 years had already started before the government delivered the AI statement in 2018. WASP has a strong emphasis on academic research coupled to the needs of Sweden's main export industries. Overall, the private sector invested SEK 5.6 billion (€ 560 million) in AI-technologies in 2019 while the public sector invested approximately SEK 150 million (€ 15 million) in digitalization.

Different national authorities in Sweden have a general mandate to organize their own work as long as it is within the government assignment and budget. Several authorities have therefore invested in digitalization of their services, such as social benefits and declaration of taxes. In 2018 a new authority was also created with the specific assignment of facilitating the digitalization of public administration, the Agency for Digital government. The agency for innovation shifted focus towards AI at the same time but the new

7. Summary authored and provided to be included in this report by RISE and is also found in Ailisto, H., Burden, H., Stenberg, S., Bodea, G., van Ette, F., Lazo, C.B. (2023). A Comparison of AI Policies and Programmes in Finland, the Netherlands and Sweden – Case Finland. White Paper. VTT

ambitions were again within existing budget and mandate. One of the initiatives was the creation of AI Sweden together with two regional municipalities. The ambition was to create and facilitate a hub for the actors within the ecosystem and mitigate the perceived fragmentation of initiatives.

AI Sweden was created by funding from three public bodies where the Swedish innovation agency contributed SEK 100 million (€ 9 million) over five years. The funding was enabled by a re-prioritization within the existing budget. Other examples of initiatives within budget are life-long education of professionals, labs and resources and an SME strategy, totaling less than SEK 100 million (€ 10 million). The Swedish research institute RISE was at the same time created and assigned by the Government to facilitate the application of "advanced digital services and tools", equivalent to SEK 70 million (€ 7 million) over four years. The assignment reflects the national policy statement from 2018.

The Swedish public initiatives have focused on developing digital infrastructures such as data labs enabling data sharing, common interfaces for data access and resources for cyber security, besides AI uptake. Another perspective is how national authorities have invested in

digital services for citizens and automated decision-making systems. The latter is not necessarily perceived as AI since they need not rely on machine learning but classical rule-based AI.

In Sweden the publicly funded initiatives have been managed within existing mandates and budget and therefore followed the usual audit and evaluation procedures. This has been complemented with specific governmental assignments to promote AI competence within public administration and a new authority for the overall digitalization of government. Their mandate is to provide guidance and recommendations. This means that it is business as usual in terms of publicly funded initiatives relating to AI in terms of funding and evaluation. Similar approaches have for instance been applied for life-science, a Swedish strategic business area.

In 2018 the Swedish innovation agency recognized the fragmentation of the Swedish ecosystem and initiated instruments to increase career mobility between academia and industry. The strategic innovation programmes funded by the agency were also asked to increase AI awareness in their research agendas. The gap is still a priority and one of the focus areas of AI Sweden and RISE. In 2022 the Swedish innovation agency

initiated a restructuring of the strategic innovation programmes towards mission-oriented research agendas. The initiative will transition into second phase in 2023 and it is too early to assess the impact of the changes.

4.3 Comparison

There are four areas in which many differences and similarities have been discovered through the analyses of Finnish and Swedish strategy (Ailisto et al. 2022; Burden et al. 2023). These are the initial conditions; the role of government; the approach to strategy; approach to implementation.

4.3.1 Initial conditions

Finland, Sweden, and the Netherlands rank high among EU countries in indexes comparing AI competence and readiness as well as in start-up funding. However, in global ranking among developed countries, the three countries position in the middle category. Figure 4.2 shows the rankings of the three EU Member States in three relevant indices: the Digital Economy and Society Index (DESI), the Government AI readiness index, and the AI Vibrancy index.

DESI is a composite index describing the digitalization of Member States in broad terms. The components are human capital, connectivity, integration of digital

technology and digital public services (European Commission, n.d.). Here, the three countries are consistently ranked in the top 4 with Finland taking the lead. The Government AI readiness is a global index by Oxford Insights that tries to answer how ready is a given government to implement AI in the delivery of public services to their citizens. It focuses on governance, technological/human capital and data infrastructures (Oxford Insights, 2022). The AI readiness index shows the greatest deviation between the three. A major contributing factor is that possession of an AI strategy is one of the dimensions (Oxford Insights, 2019). Thus, the Netherlands 'caught up' with Finland and Sweden, which is visible in the strong increase in ranking within 3 years. Third, the AI Vibrancy index is another global index that is more focused on R&D, such as publications, citations and patents, and investment, such as private investment and newly funded companies (Stanford, n.d.). This shows that the three countries are also in a similar position of growing 'vibrancy', meaning more R&D&I over time.

4.3.2 Role of government

In the role of the government there are several noticeable similarities and differences. The strategies themselves are position papers that aim for concepts as trust, openness, and transparency, and are

using (or considering) a mission-oriented approach. However, the ambitions of the three Member States differ, as well as their uptake of digitalization in the public sector.

Government ambitions

In 2017, Finland had the ambition to become a frontrunner in AI (Ailisto et al., 2022). The Netherlands, by contrast, adopted a more 'wait-and-see' approach and focused on finetuning the AI strategy across ministerial departments before publishing the national AI strategy. Also, the Finnish approach was comparatively more centralized and top-down, which favours speed and agility over meticulous preparation, but is less inclusive of SMEs and civil society (Ailisto et al., 2022). Moreover, Finland saw a political shift in 2019 from centre-right (cabinet-Sipilä) to left-green-centre (cabinet-Rinne and cabinet-Marin), which changed the emphasis from national competitiveness to threats and ethical concerns of AI (Ailisto et al., 2022).

Trust and human-centeredness

In the Netherlands, trust is one of the main goals of the AI strategy, as it is one of the pillars of SAPAI and the ELSA lab concept is widely applied. For Finland and Sweden these goals are somewhat similar, namely openness, transparency, and trust (Larsson et al., 2020, pp.29-30).

Missions and transitions

Both Netherlands and Sweden emphasize a mission-oriented approach. NL has a strong focus on societal challenges (e.g. through NWA, NGF, Mission-oriented innovation policy). For Finland, mission-oriented projects with more ambitious and broader
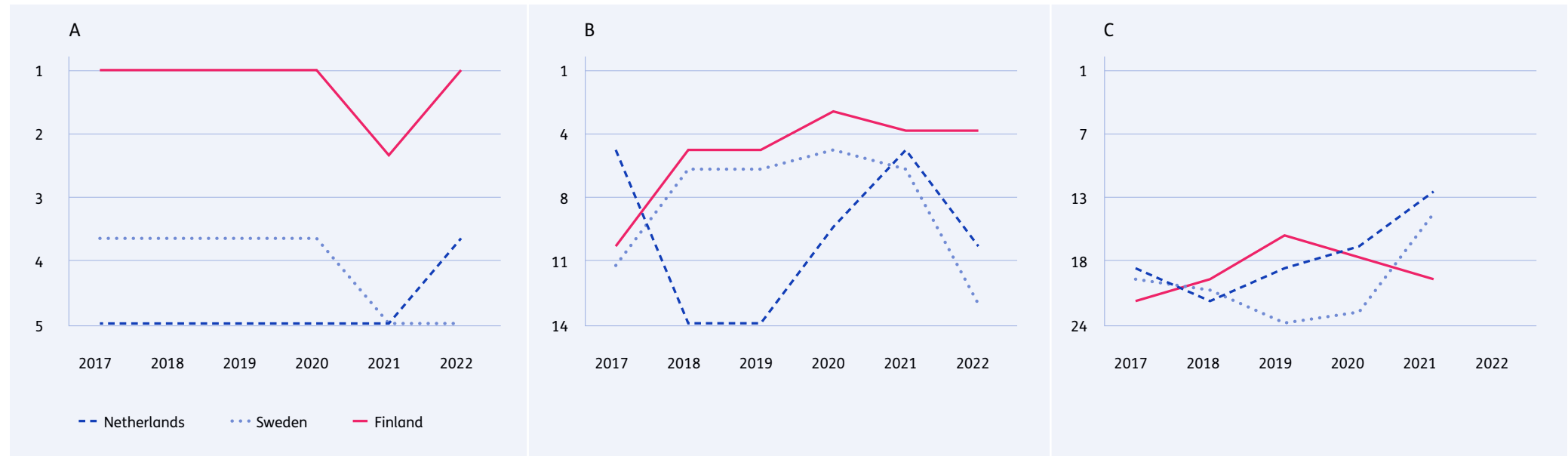

Figure 4.2. Rankings between 2017-2022 of the three countries in this comparative study. (A) The DESI, (B) the AI governmental readiness index, (C) the AI Vibrancy index (Source: Authors' elaboration based on data from the European Commission, Oxford Insights and Stanford University).

goals than current rather small separate R&D&I projects are called for (Ailisto et al., 2022). Finland should consider ecosystem project for AI, broader and more strategic than single projects. The ecosystem project would consist of companies who "have seen the light" and aim at significant impact by using AI broadly. Research partners would contribute with their competence.

Position taken, but larger AI strategy missing

The national AI strategies are high-level position papers, non-binding, and inventories of existing initiatives. Since AI technologies become woven into processes, organizations, products, and services, it should be critically evaluated, how much Finland should emphasize pure AI research or more application-oriented research for applying AI into industry, public services, and into other sciences (Ailisto et al., 2022). In the Netherlands, the WRR draws a similar conclusion, naming AI a 'systems technology' and recommending drastic changes (Wetenschappelijke Raad voor het Regeringsbeleid, 2021).

4.3.3 Approach to strategy
In the approaches to the strategy, there are several differences. These are stakeholder involvement, the time span of programmes and career mobility between industry and academia.

Stakeholder involvement

In line with the Dutch 'poldering' model of governance, where government seeks compromise and (broad) consensus to come to an agreement, the Dutch AI strategy emphasizes broad collaboration and an inclusive approach in engaging stakeholders – including civil society. The NL AIC and AiNed aim to have a strong Quadruple Helix principle, and the NL AIC has over 495 member organisations. This approach differs in three places:

First, it is less agile than the Finnish approach, who seem to be keen to be the first and focused on growth and international competition. Building coalitions through PPPs is something that Finland has done to a lesser extent. Industry–research alliances existed between 2010–2015, but after governmental financial support ended, only two survived. In other words, both countries made different trade-offs in flexibility and agility versus durability and inclusiveness.

Second, the government is put in a role of supporting stakeholder decision-making and incentivizing PPPs. The Dutch PPP model is built on more than 10 years of innovation policy stimulating the formation of (sectoral) PPPs. Over time, the Netherlands has developed and improved specific instruments that lever public funds to maximize private investment in R&I. This in comparison to Sweden, where the AI strategy is already driven by large private investments. In the Netherlands, the government seems therefore more in a position of the coordinating party than the Swedish government.

Third, instead of opting for a centre of AI excellence (a 'lighthouse'), a distributed network of regional hubs was formed across the entire country. These have their own expertise and engage with, like the European Digital Innovation Hub model. This regional hub model has a stronger and more "official" status than in Finland.

Time span of programmes

The Netherlands has relatively many long-term funding programmes, projects and labs (7 years, 8 years, 10 years). In Finland 2 – 4 years is typical, except for so called 'flagships', where it is 4 + 4 years. A contributing factor to the Dutch long-term approach is the adoption of mission-driven innovation policy which is inherently long-term, as their horizon is 10 years or more (Ministry of Economic Affairs and Climate Policy, 2021). In Sweden, WASP is a much longer programme, lasting from 2003 until at least 2030 (Burden et al., 2023). The longer term of programmes and policy gives more time to build long-term impact but requires more attention to agility in order to maintain space to deviate based on new insights.

Career mobility

In Finland it is much easier and much more common to switch between academic career and industry career and vice versa (Ailisto et al., 2022). Meanwhile, in the Netherlands this occurs to a lesser extent (e.g. parttime professorship). It could be beneficial because it stimulates knowledge transfer. In Sweden this has become the focus to overcome a fragmented ecosystem (Burden et al., 2023).

4.3.4 Approach to implementation
Implementation of the strategy also shows some similarities and differences. All three Member States experience a gap between industry and research, and a gap between existing instruments and new programmes. The main difference is the focus of the national programmes.

Gap between industry and research

The gap between industry and research is shared among the three countries, although in different forms. As the use of research results, the impact of Finnish research remains weaker than it should and focus and resources should be put in bridging the gap through applied research and other means (Ailisto et al., 2022). In the Netherlands, due to several reasons, there is a slight shift to fundamental research (see section 3.2.5). In Sweden this gap occurs because of the large proportion of private funding for AI research (Burden et al, 2023).

Instruments may not be fit for purpose

In Section 3.2.5 the rationale of the instruments in the Netherlands is described. For Finland, the national technology programmes would have much stronger impact if the implementation of recommendations was assigned to specific actors (Ailisto et al., 2022). Furthermore, according to Ailisto et al. (2022), the enactment of recommendations for the public sector, such as administration or health care, should be allocated to respective authorities. Research can be directed via funding programmes, as has been already done. Private sector investment can be guided by R&D&I funding, public procurement, tax reliefs or regulation. Naturally, this approach would require resources to be allotted to the responsible players.

National programme focus

While the amounts of funding are somewhat similar, the main investment programmes have a different focus. In Sweden WASP focuses on fundamental AI research, and the national strategy focuses on complementing this by helping public sector uptake of AI (Burden et al., 2023). In Finland the focus is on AI use by companies (Ailisto et al., 2022). In the Netherlands it is a mix of both (AiNed).

5 Conclusion

In this report, we discussed the Dutch national AI strategy and related policies and programmes; and conducted a brief comparison with similar initiatives in Finland and Sweden. Many other Dutch strategies and policies that touch upon AI, but where AI is not a core component – or where there is a technological dependency with AI (e.g. High-Performance Computing) were left out of this study, and only briefly alluded to in Section 2.3.5. While the policy landscape has become much more complex (Figure 2.1), the Netherlands AI strategy was specifically developed to integrate many initiatives (e.g. AINED, ICAI, NL AIC, Appl.AI) that emerged from existing structures, directing them more specifically towards goals such as trustworthy and human-centric AI. These goals are also shared by Finland and Sweden, the other two countries examined in the comparative section of this study.

The Dutch national AI strategy SAPAI aimed to contribute to welfare and wellbeing. Published in 2019 in response to a call to action by the AINED consortium, it brought together several actions in a single document that encompassed views and responsibilities for the AI strategy shared across ministries. The AINED call to action was inspired in part by countries that had published AI strategies earlier on (such as Finland and Sweden) aimingto

become frontrunners in AI. What all three strategies shared was their high-level approach, and the absence of a concrete roadmap to achieving set goals. So far, while an 'update' of SAPAI has not taken place, new and broader policies for digitalisation and the digital economy – where AI plays an important role – have been published.

The analysis shows that the Netherlands opted for an inclusive process of broad stakeholder involvement and ecosystem building, to an extent which is not observed in Finland and Sweden. Forging the NL AIC AI ecosystem was an important step and the availability of funding to support the launch of the initiative was critical. As the NL AIC grew, it prepared the strategic R&D&I investment programme AiNed which started being implemented in 2022, after receiving a grant from the National Growth Fund.

The use of existing (funding) instruments is a shared practice across the three EU Member States. In terms of mission- and transformative innovation policy, the Netherlands is an early adopter, and the approach is increasingly used in Finland and Sweden.

Similar for all three EU Member States included in this study is a perceived gap

between research and industry with regard to AI, and actions undertaken by their respective national programmes to bridge that gap. Specifically in the Netherlands, AiNed encourages applications of AI, however the mechanisms used (NWO, a more science-focused route) is primarily fundamental research oriented.

Besides a comparison of the three EU Member States, we aimed to obtain meaningful, quantitative lessons and (expected) impacts by interviewed relevant stakeholders that were involved in the establishment of the NL AIC or are currently involved in the NL AIC. It is impossible for us to say whether a strategic decision was 'good' or 'bad', but from the variety of viewpoints we did learn that in the Netherlands AI several strategic choices were made, either explicitly or implicitly, in accordance to the national context. So, we conclude that the effectiveness of the AI strategy depends on the making choices mainly along the following six dimensions:

1. The role of the (national) government: ranging from supporting bottom-up initiatives to top-down leadership.
2. The (re)use of instruments: ranging from use of existing (policy, financial, etc.) instruments to development of new instruments.

3. Degree of stakeholder inclusion and consensus building: ranging from inclusive stakeholder participation to speed of action.
4. Emphasizing collaboration or competition: ranging from broad participation and collaboration among many categories of stakeholders; to high competition between ideas and consortia.
5. Focus of R&D&I investment: ranging from focus on ground-breaking fundamental research to focus on applied AI research.
6. Attitude towards (international) collaboration and positioning: ranging from individual participation in a so-called 'AI race'; to close (international) cooperation on developing AI to address shared (global) challenges.

Unfortunately, it is not possible to come up with the perfect strategy that works for all countries. While we were not able to find a 'silver bullet' for a national AI strategy during this study, our comparison and case study show that some practices and problems are common across countries. Most of all, and whatever the shape and choices made during the early stages, developing and maintaining a national AI strategy is best regarded as a continuous process of learning, reflection and adaptation.

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Appendix A. List of interviewees

Interviewee	Relation
Emile Aarts	Former chair working group Human-centric AI at NL AIC and lead ELSA Labs
Erik Wijnen	Policy advisor at the Ministry of Economic Affairs and Climate Policy (MinEZK)
Henk Jan Vink	Former chair Programme Advisory Council (PAR) AiNed
Inald Lagendijk	Board member AiNed
Kees van der Klauw	Coalition manager NL AIC
Maarten van Steen	Chair working group Research & Innovation NL AIC
Willem Jonker	Chair AiNed
Wim Kees Janssen	CEO of Syntho.ai, member NL AIC
Ildikó Vadja	Senior advisor at Patiëntenfederatie, member NL AIC

Appendix B. Benchmark data

These are the rankings of the Netherlands, Sweden and Finland in the Digital Economy and Society index[8] (comparing EU Member States), the Government AI Readiness index[9] (global) and AI Vibrancy index[10] (global), from 2017-2022.

The Digital Economy and Society Index (DESI) is a composite index describing the digitalization of Member States in broad terms. The components are human capital, connectivity, integration of digital technology and digital public services (European Commission, n.d.). Here, the three countries are consistently ranked in the top 4 with Finland taking the lead.

The Government AI readiness is a global index by Oxford Insights that tries to answer how ready is a given government to implement AI in the delivery of public services to their citizens. It focuses on

governance, technological/human capital and data infrastructures (Oxford Insights, 2022). A major contributing factor is that possession of an AI strategy is one of the dimensions (Oxford Insights, 2019).

Third, the AI Vibrancy index is another global index that is more focused on R&D, such as publications, citations and patents, and investment, such as private investment and newly funded companies (Stanford, n.d.).

	2017	2018	2019	2020	2021	2022
DESI	4	4	4	4	4	3
	3	3	3	3	4	4
	1	1	1	1	2	1
AI readiness	5	14	14	9	5	10
	11	6	6	5	6	13
	10	5	5	3	4	4
AI vibrancy	19	22	19	17	12	-
	20	21	24	23	14	-
	22	20	16	18	20	-

■ Netherlands   ■ Sweden   ■ Finland

Table B.1. AI Rankings of the Netherlands, Sweden and Finland, 2017-2023. Sources: DESI, Governmental AI readiness index and AI Vibrancy index

8.   DESI is an index published by the European Commission: https://digital-agenda-data.eu/
9.   The Government AI readiness index is published by Oxford Insights: https://www.oxfordinsights.com/government-ai-readiness-index-2022
10. The AI Vibrancy index is published by the Stanford University Center for Human-Centered Artificial Intelligence: https://aiindex.stanford.edu/vibrancy/

Appendix C. Timeline of AI policy events

This appendix presents aa selection of events linked to the Netherlands AI strategy. It covers the period 2011-2023. The Roman numerals in the first column indicate during which cabinet term the event occurred (starting with cabinet-Rutte I and ending with cabinet-Rutte IV).

The colours in the table indicate the type of AI policy:

- Blue = AI-specific

- Yellow = Innovation & industrial policy

- Orange = Digital government & digital economy

- Green = other AI-related events

Table C.1. Selection of events relevant to the Netherlands AI strategy, 2011-2023.

CO	Date	Event
I	2011	The Ministry of Economic Affairs, Agriculture and Innovation introduces the top sector policy to stimulate investment and innovation in nine prioritised sectors.
		Digital Agenda.nl & Digital Implementation Agenda.nl (2011-2015) published by the MinEZK – a policy agenda for the digital economy & digital skills
	Nov 16, 2011	COMMIT/ (2011-2017), an ICT research program, is founded and established as a public-private partnership.
II	Fall 2014	The top sector policy is adapted and the Top Team ICT is founded
	Nov 2014	The Smart Industry programme – aiming to accelerate the digitalization of the Dutch manufacturing industry – is started by MinEZK, TNO, KvK, Metaalunie, FME and regional development organisations (ROMs)
	Sep 2015	Top Team ICT publishes the Knowledge & Innovation Agenda (KIA) ICT 2016-2019, allocating €40 million for ICT R&D&I
	Nov 2015	Top Team ICT publishes the Human Capital Agenda ICT (2015-2020)
	Nov 27, 2015	NWO publishes the Dutch Research Agenda (NWA)
	2016	Founding of COMMIT2DATA, a national PPP (2016-2020) focused on (big) data science research
	Jul 2016	New Digital Agenda, focused on 2016-2017
	Feb 6, 2017	Rathenau presents its report 'Upgrading', showing that the government, regulators, industry and society are not well equipped for digitalisation.
III	Mar 2018	Innovation Centre for AI (ICAI) is launched, led by the University of Amsterdam and the Vrije Universiteit Amsterdam – organizing labs around AI applications.
	Apr 21, 2018	The Netherlands Cyber Security Agenda (2018-2022)
	Jun 1, 2018	The Netherlands digitalisation strategy (2018-2021) is published by MinEZK
	Jun 2018	Elsevier Research publishes MinEZK-commissioned report on 'quantitative analysis of research and innovation in key enabling technologies in the Netherlands' identifies AI (digital technologies) as one of the KETs for NL
	Jul 1, 2018	The Digital government agenda (DIGIbeter) is published by a government-wide organ with representatives of the national gov't, provinces, municipalities

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CO	Date	Event
III	Oct 2018	AINED, a collaboration between Topteam ICT, VNO-NCW, ICAI, NWO, TNO and supported by Boston Consulting Group and DenkWerk, offers the report 'AI for the Netherlands' to State Secretary for Economic Affairs and Climate Policy Mona Keijzer, triggering the government to develop a national AI strategy
	2018	On behalf of the national government, State Secretary Mona Keijzer (EZK) submits a request for advice with the WRR
	Apr 26, 2019	The Dutch innovation policy is adapted to a mission-driven top sector and innovation policy around 4 themes: 1) Energy transition & sustainability; 2) Health & care; 3) Agriculture, Water, Food; 4) Safety & security
	Jul 18, 2019	The director-general Business & Innovation, MinEZK (Focco Vijselaar) sets up a Taskforce AI, consisting of: VNO-NCW & MKB Nederland, ministry of MinEZK, TNO, Topteam ICT (Dutch Digital Delta), VSNU, large corporations (Ahold, Seedlink, Philips, IBM) and Kees van der Klauw (to become the NL AIC)
	Jul 2019	Taskforce AI publishes a position paper on the role, governance, and investment plan for a national AI ecosystem – the Netherlands AI Coalition
	Aug 30, 2019	A consortium of Dutch universities, receives €19 million from the Dutch Research Council (NWO) 'Zwaartekrachtprogramma' to research Hybrid Intelligence
	Oct 1, 2019	Kennis- en Innvoatieagenda-ICT (Knowledge and innovation agenda) 2018-2021 published
	Oct 8, 2019	State Secretary Mona Keijzer presents the national AI strategy, 'Strategic Action Plan for AI' (SAPAI), regarding public sector use of AI identifying open data as a strenght of the Netherlands.
	Oct 8, 2019	Attached to the SAPAI are two letters of government, specifically: • Cabinet vision (Ollongren, MinBZK) 'AI, public values and human rights' published focusing on transparency and accountability • Safeguards against risks of data analyses by the government (Dekker, MinOCW)
	Oct 8, 2019	The Netherlands AI Coalition (NL AIC) kicks off and presents their Action Agenda – the NL AIC is a PPP, initiated by VNO-NCW, MKB-Nederland, the ministry of MinEZK, TNO, Topteam Dutch Digital Delta, IBM, Seedlink, Philips, Ahold Delhaize en FME
	Oct 10, 2019	Five Dutch companies - Ahold Delhaize, ING, KLM, Philips and NS announce a collaboration named Kickstart AI
	Oct 15, 2019	Holland High Tech (Topsector High Tech Systems & Materials) publishes the Kennis- en Innovatieagenda Sleuteltechnologieën 2020-2023 with a budget of €667 million – to steer the development of KETs such as AI with the goal of supporting the mission-driven top sector & innovation policy with technological contributions and creating future economic opportunities. Several of its multi-annual plans focus on AI.

- Blue = AI-specific

- Yellow = Innovation & industrial policy

- Orange = Digital government & digital economy

- Green = other AI-related events

CO	Date	Event
III	Nov 1, 2019	NWO, NL AIC publish the Artificial Intelligence Research Agenda for the Netherlands
	Jan 30, 2020	AWTI offers advice 'Stronger selection for Key Enabling Technologies', recommending to form coalitions around KETs such as AI
	2020	CLAIRE, an AI research association, establishes in The Hague
	Feb 5, 2020	The Dutch court rules that SyRI – under public scrutiny since 2014 – is in violation with the European Convention of Human Rights. SyRI was a data mining system used by the government to detect fraud
	Jul 17, 2020	The Dutch Data Protection Authority concludes that the dept. 'Benefits' of the Dutch Tax Authority discriminated by processing people's nationality in fraud detection
	Sep 8, 2020	The Senate appointed a working group 'AI', aimed at improving knowledge of the Senate on AI.
	Sep 28, 2020	Amsterdam starts the first algorithm register
	Jan 26, 2021	Algemene Rekenkamer report 'Attention to Algorithms', noting that the government is using more algorithms.
	Feb 10, 2021	A consortium from the NL AIC submits a proposal for AiNed (2021-2027) to the National Growth Fund
	Mar 11, 2021	The cabinet office awards the NL AIC consortium a start impulse of €23.5 million for 5 years, for research and development of AI applications, through the TNO Appl.AI programme
	Apr 2021	The House of Representatives establishes a committee for Digital Affairs
	Apr 9, 2021	The AiNed consortium is granted €276 million from the National Growth Fund to implement the 1st phase of their proposal for a National AI research centre
	Apr 22, 2021	The Opschalingsplan 2021-2025 for the Human Capital Agenda ICT is published
	Jun 28, 2021	Raad van State publication on digitalisation in (administrative) law
	Sep 6, 2021	The CIOs of all ministries and executive organisations present I-strategie Rijk, a joint strategy for improving information provision in the government
	Nov 11, 2021	WRR published report 'Mission AI. The New System Technology'
	Dec 15, 2021	New coalition agreement for cabinet-Rutte IV, mentioning that the cabinet will stimulate AI innovation and investing in the technology, underlining the importance of fundamental civil rights online
	Jan 2022	The AiNed R&D&I investment programme is published

- Blue = AI-specific
- Yellow = Innovation & industrial policy
- Orange = Digital government & digital economy
- Green = other AI-related events

CO	Date	Event
IV	Mar 1, 2022	The MinEZK starts a new directorate general for Economy & Digitalisation (Formerly the ICT-innovation cluster in the MinEZK directorate 'Regulatory pressure')
	Mar 8, 2022	Minister for Kingdom Relations and Digitalization presents a Parliamentary letter with the main features of the digitalization strategy
	Mar 10, 2022	Ministry of Economic Affairs and Climate Policy and InvestNL launch the Deep Tech Fund (DTF), aimed at investing in knowledge intensive start- and scaleups
	Jul 2022	An interdepartemental Ambtelijke Commissie Digitalisering (ACD) is instated, to prepare policy on digital affairs
	Oct 7, 2022	Cabinet response to WRR report
	Oct 10, 2022	The Netherlands Cyber Security Strategy 2022-2028 is published
	Nov 4, 2022	Following the announced digitalization strategy of March 8, a Working Agenda 'Value-driven digitalisation' is presented by Minister for Kingdom Relations & Digitalisation (MinBZK) Van Huffelen
	Nov 11 2022	Letter to Parliament 'Action plan Innovatie en impact' – adaptations to the Dutch innovation policy
	Nov 18, 2022	The Strategy Digital Economy is published by the MinEZK
	Dec 20, 2022	The Dutch Algorithm Register goes online
	Jan 10, 2023	The ROBUST programme of ICAI is awarded funding from NWO, with a total project budget of over € 87 million
	Jan 18, 2023	Discussion on AI and public values with knowledge institutes and civil society, in preparation of the parliamentary debate of January 25
	Jan 25, 2023	Parliamentary committee on digital affairs debates the Cabinet's response to WRR report 'Mission AI. The New System Technology' and asks the Minister for Economic Affairs and Climate Policy questions (originally planned for Oct 6)
	Mar 28, 2023	Parliamentary (plenary) debate following the debate of January 25
	May 1, 2023	The MinBZK starts a new directorate general for Digital Society

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