

C2D

SPECIAL

Commit
2
Data



connecting business and science

- Putting data to work**
- Resilient greenhouse control**
- Sport in high humidity hotness**
- 17th century houses coming to life**
- Saving lives with data**

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Introduction

Boudewijn Haverkort

It was late 2015 when René Penning de Vries, in his role as the leader of the top team ICT, approached me with the question if I would be interested in leading the Commit2Data programme, an initiative to give a number of economic sectors a boost to transition from a traditional industry to a sector making intensive use of the possibilities of what was then called big data.

What started with a small group of committed people and organisations, a whitepaper, and a financial commitment by NWO, TNO, and the Ministry of Economic Affairs has grown into the Netherlands' largest data-oriented research programme to date over the past eight years.

Over the course of 2024, Commit2Data will come to an end. Though there will probably be some projects that will extend to 2025, the vast majority of the research will have been done, the papers will have been submitted, and the PhD researchers will have successfully defended their theses.

With this magazine, we want to provide a glimpse of what Commit2Data has been about. What was the rationale behind the programme, and how have these intentions played out in reality? What societal organisations and companies have been involved in the calls and projects, and why were they inclined to invest their time and money in this? What could a Commit2Data project look like, and how does the researcher involved look back on it? How have individual projects contributed to societal themes like Energy or Sports? What has the valorisation approach we took in this programme entailed, and what has it led to? What takeaway messages have the four founding partners of the programme learnt over the past eight years? And where will data science go from here?

We hope you enjoy reading this magazine as much as the programme bureau has enjoyed running this programme and that it leaves you in awe of what is possible if the right people decide to join forces at the right time.



CREDITS

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EDITORS

Aldert de Jongste, Pieter van Kuilenburg, Eline Pronk, Coen Wesselman

FINAL EDITING

Sonja Knols

TEXT CORRECTION

Dave Thomas, NST Science

CONTRIBUTORS

Marysa van den Berg, Leendert van der Ent, Sonja Knols, Bennie Mols

DESIGN

WAT ontwerpers

PHOTOGRAPHY

WAT ontwerpers (cover, p. 4, p. 18, p. 19), ECP (p. 6), Bram Saeys (p. 7), Virtual Interiors project (p. 8), iStock (p. 4, p. 9, p. 10, p. 19, p. 23), Ivar Pel (p. 16), Gijs van Ouwkerk (p. 24)

CONTACT

+31 (0)70 419 03 09
info@commit2data.nl
commit2data.nl/en

DATA AS KEY TO PROSPERITY

By Sonja Knols

Images WAT ontwerpers/iStock

‘Digitalisation blurs traditional boundaries. Computer scientists need to collaborate with other disciplines to shape our future society. The Commit2Data programme has been one of the first steps in such an integration.’ The programme’s chairperson Boudewijn Haverkort and general secretary Aldert de Jongste look back on some eight years of connecting data science to top sectors.

To overcome the aftermath of the 2007-2008 Global Financial Crisis and to stimulate investments in innovation, the Dutch government initiated the so-called top sector policy in 2011. Initially, ICT was identified as an enabling theme, cross-cutting all nine top sectors. The top team ICT, led by René Penning de Vries, was installed to foster and initiate ICT innovations for the various sectors of the economy.

In 2015, this top team issued a white paper in which they proposed a ‘National Public-Private Research and Innovation Programme on Data Science, Stewardship and Technology across Top Sectors’ called Commit2Data. This white paper laid the foundation of the programme as we know it now, explain chairperson Boudewijn Haverkort, Dean of the Tilburg School of Humanities and Digital Sciences at Tilburg University, and general secretary Aldert de Jongste, Programme manager at ECP | Platform for Information Society.

Commit2Data was set up by the Ministry of Economic Affairs, NWO, TNO and the top team ICT as a public-private partnership focusing on the application possibilities of big data and the new business models and opportunities that big data creates. The programme was organised as a matrix: on the vertical axis, the top sectors represented application-oriented themes. On the horizontal axis, several more scientifically fundamental challenges relevant to all key sectors were defined.



Aldert de Jongste:
 “When data science was still in its infancy, we already forced people from different economic sectors to think about data components in their work”

Unique programme

In many regards, the programme had a unique character, Haverkort and De Jongste emphasise. ‘First of all, though NWO, as the main public funding agency involved, had allocated 45 million euros to the programme as a whole, that budget would not be spent all at once. It was to be granted through separate calls, which should each be defined in collaboration with public and private parties from the respective top sector’, De Jongste says. ‘This distributed character of the programme clearly had its pros and cons’, Haverkort adds. ‘On the upside, we were able to design calls tailor-made to the needs and characteristics of a sector. That way, the sector could recognise itself in it and see the advantages of engaging in the programme.’

The programme made a flying start by issuing its first call in early 2016 on Logistics. ‘There we gratefully made use of the Logistics sector’s existing level of organisation’, Haverkort recalls. ‘They were on the subject of big data

early because there had been discussions about standards for data exchange in a European setting. We decided to incorporate their research activities into our own scheme. In other domains, we first had to create awareness of the topic’s importance.’ ‘These sectors each struggle with their own challenges, and the availability of data greatly differs amongst them’, De Jongste says. ‘The same goes for the extent to which data is allowed to be shared’, Haverkort adds. ‘For each new call, we would typically approach a figurehead from a specific top sector and interview them about their ideas and needs when it came to big data. That is reflected in the vastly different nature of the projects in the various sectors. For example, projects in the Sport and Exercise theme have a less hardcore data science component and the work is more of an applied nature than projects in the Logistics theme’, says De Jongste.

As a result of this approach, in practice, Commit2Data acted as an umbrella over a set of subprogrammes, each with their own unique character, way of working and timeline. ‘It was enriching to see how different top sectors and the associated NWO domains operate’, De Jongste observes. ‘For example, in the Health domain, ZonMw organised some extensive multi-day matchmaking meetings. These not only resulted in excellent research proposals but also in fruitful new consortia which extended beyond the Commit2Data programme and resulted in other collaborative projects as well.’

Community of communities

The downside of the distributed nature of the programme is that it was hard to build a true Commit2Data community, Haverkort says. ‘All in all, Commit2Data consists of 10 subprogrammes, in 8 different sectors. Within these different sectors, communities have certainly formed, but across the programme as a whole, that turned out to be more of a challenge. As a result, though we are the biggest Dutch research and innovation programme in data science to date, we are unable to provide a complete overview of the output the programme created.’ ‘Initially, we had hoped that the cross-cutting scientific themes would act as the glue keeping all of the different sectoral calls together. That didn’t work out as intended. If there was any exchange of knowledge, it was on a more personal level where individual researchers were active in multiple themes’, De Jongste concludes.

About halfway through the programme, the programme board decided to take some additional action to stimulate the valorisation of the research. De Jongste: ‘In the original white paper, the action lines involving the research programme were well-thought-through. The valorisation part of the programme needed some additional work, though. Through a separate proposal to the Ministry of Economic Affairs, we managed to acquire some additional funding for this line of action.’

Commit2Data in

NUMBERS

- Budget: **€ 62 million**
(of which € 17 million in private funding)
- Via NWO **13 research** calls were launched.
- More than **60 research projects** have been funded.
- **200+ private parties** participate.
- **83 PhDs - 56.5 postdocs** -
16 programmers and other positions.
- **5 TNO and 18 NLeSC engineers.**
- Valorisation budget of **€ 2 million** over six years.
- Dedicated **valorisation coach** for advise and support.
- **8 Valorisation calls** via NWO Take-off instrument.

Both Haverkort and De Jongste agree that the dedicated valorisation coach is one of the most successful elements of the Commit2Data valorisation programme. The coach actively approaches the project leaders to scout for potential commercially or societally interesting topics and inspires them to look at their research from a market perspective. What's more, when he thinks a certain project might be worth valorising, he goes beyond the project leaders and searches for the best people to take up this task. Very often, these are PhD researchers, since they are much closer to the subject and often eager to take their results further. The valorisation coach challenges the researchers by asking questions about the merits of their findings and points them towards experts, funding possibilities and relevant organisations to partner up with.

'This freedom to operate with some of the additional funds makes a lot of difference in the effectiveness of the approach', says De Jongste, who is the first to admit that it would have been even better if the Commit2Data programme had developed and embraced such a valorisation programme right from the start. 'That would have helped achieve a certain mindset among the researchers, which is harder to build later in the process.'

Acceleration

Although they are not afraid to mention the programme's lesser points, Haverkort and De Jongste are, on balance, happy about how the programme turned out. Haverkort: 'Commit2Data acted as an early example of how computer science can collaborate with other disciplines to advance both science and society. The Dutch Research Agenda calls in data science and artificial intelligence are clearly inspired by how we approached this in Commit2Data. And though there is no one-on-one formal follow-up, the programme certainly has brought about an acceleration in building a knowledge position when it comes to big data and data science. For example, in the Smart Industry programme, predictive maintenance as a field has grown tremendously in size and attention, with multiple follow-up projects. What's more, the Commit2Data programme has acted as a stimulus for the renewal of educational programmes, leading to a build-up of human capital that is indispensable to tackle the challenges the development of artificial intelligence brings about.'



Boudewijn Haverkort
'Commit2Data has acted as an early example of how computer science can collaborate with other disciplines to advance both science and society'



De Jongste: 'When data science was still in its infancy, we already forced people from different economic sectors to think about data components in their work. Thus, this programme has led to more awareness about the merits and pitfalls of large datasets, more knowledge on how to handle data, and the formation of new ecosystems within the top sectors involved. Recently, one of the projects in the health theme organised a closing event. The fact that over 300 people showed up for that final congress says it all.'

Virtual Interiors of the Dutch Golden Age

Historical research is based on a large amount of data. The Commit2Data project Virtual Interiors as Interfaces for Big Historical Data Research tries to make sense of these data by building digital maps and virtual rooms that could help historians, says Chiara Piccoli, one of the participating researchers.

By **Marysa van den Berg**

Image Virtual Interiors project, Wikimedia

The 17th century was an age of masterful painters, scientific discovery, and flourishing cities in the then Republic of the Seven United Netherlands. ‘Amsterdam, in particular, became a very important cultural centre’, says Chiara Piccoli, Research Fellow at the 4D Research Lab at the University of Amsterdam. ‘So, this is a period for which a lot of historical data is available. One of our aims was to create interactive interfaces that could function as hubs for all this data and that can help historians with their research.’



The 3D reconstruction hypothesis of the residency of Pieter de Graeff and his spouse Jacoba Bicker can be viewed 3d-demo.virtualinteriorsproject.nl/index.html?app=pdg-entrance-hall&fps=30

A special diary

The Virtual Interiors project started in September 2018 and consisted of three subprojects. One was targeted at building a prototype web viewer that visualises historical data and makes it more accessible. This was done by Piccoli’s colleague Hugo Huurdeman. In another subproject, Weixuan Li used GIS to map the locations of painters’ workshops. And lastly, Piccoli’s own project was about virtual interiors themselves. She zoomed in on a selection of houses.

The houses were chosen based on the amount of data available. ‘For the house of the Dutch East India Company director Pieter the Graeff (1638-1707) and Jacoba Bicker (1640-1695) at Herengracht 573, I could work with



a very rich dataset’, says Piccoli. ‘Their house has been modified over the centuries, but parts of it are still there. That already gave me a bit of info about the placing of certain rooms.’

Pieter de Graeff in 1663,
painted by
Caspar Netscher

But there was more, continues Piccoli. ‘De Graeff kept a diary in which he frequently talked about the interiors of his home, for example the tiles used for the entrance hall. Together with the inventory of his properties, drawn up upon his death, these pieces of information helped me create a reconstruction hypothesis of this house’s interior.’

Bringing history to life

A bit more challenging was the house of the painter Gillis van Coninxloo (1544-1606). His house used to be at the Turfmarkt, but the exact location was uncertain. ‘There was an inventory of properties and that was it.’ Despite the scarcity of data, Piccoli managed to build a schematic model of the Van Coninxloo home to shed light on its spatial configuration.

The Virtual Interiors project finished at the end of 2022, but Piccoli’s work is still not done. She is now working on the reconstruction of De Graeff’s private library. ‘I really like the combination of using computer tools and historical research. And it is important in the future to have these digital tools to make history come ‘alive’’

Toward personalised mass products

The Smart Industry project Ultra-Personalised Products and Services (UPPS) investigated how emerging digital technologies such as 3D scanners, cloud services, and advanced manufacturing can be used for customisation of mass products.



In addition to the Commit2Data project, a field lab was established, supported by CLICKNL (Top Institute for the Creative Industry). In this field lab, companies and researchers used the research results to set up design processes for various products, ranging from custom-knit sweaters to custom hearing aids and special braces to prevent ankle sprains during sports. In follow-up projects, the researchers are now looking at ways to make the personalised production processes cheaper.

Automating animal welfare

As part of the 'Smart Solutions for horti- and agriculture' programme, the project 'The Youngsters' aims to improve the welfare of newly born calves and piglets by automatically detecting young animals' behaviour, position, activity, weight, temperature and heart rate. By integrating smart sensors with artificial intelligence, the project automatically provides the farmer with the required insight into the condition and risk factors of the animal. First, to achieve this goal, the most common mortality causes and most relevant health indicators were identified. Then, novel sensing and communication technologies were explored to monitor these health indicators and automatically provide early warnings to farmers in the event that anything was not right.



More resilient logistics



The goal of DATAREL (big DATA for REsiliant Logistics) is to develop innovative methods and techniques for data collection and analysis in the logistics sector

and to show how they can contribute to controlling increasingly dynamic and complex logistics processes.

In the logistics sector, data so far has only been used to a limited extent. The researchers indicated what does and does not work based on concrete use cases from project partners such as Locus Positioning, Ahrma, Innovadis, Cape Group, Ovis Telematics and Datacadabra.

The use cases have resulted in a toolbox for practical and academic issues that can be used to make logistics processes more resilient. In addition to this, the project has also contributed to a number of other interesting projects, including the OpenTrip model. This initiative may eventually become the legal standard for data collection in the logistics sector.

Prevent medication-related falls

People over 65 are at high risk of falling, mainly as a result of medication use. The SNOWDROP project developed ways to calculate personal fall risks and enable general practitioners and patients to jointly decide whether and how they want to adjust the use of medication to prevent falls.



The project has delivered a thoroughly tested model that uses information provided by health professionals about a patient's medication use, lab results, diagnoses, referrals and free text notes to predict the chance of a fall.

A number of the algorithms developed in this project are now also used to find new indications in the free text fields of patients' files as to who is at greater risk of developing lung cancer.

Within the Commit2Data research theme Sport & Exercise, scientists have examined, among other things, how to measure athletes' physical and mental resilience, how athletes can best cope with heat and humidity, and how para-athletes can best power their wheelchairs.

By Bennie Mols Image iStock

The days when elite athletes based their training solely on their own feelings and the habits of their successful predecessors are long gone. And although elite sports have experienced a scientific revolution in materials, nutrition, physiology and psychology, there is also a lot of unexplored territory that data scientists can help mine.

Resilient in body and mind

The Resilient Athletes project explored how athletes' physical and mental resilience can be measured and improved for better recovery and performance. 'We developed an app for tablets and smartphones that combines data on physical and mental resilience and gives a clear visual insight into how an athlete is doing', says project leader Ruud den Hartigh of the University of Groningen.

To realise this, Den Hartigh and his research team worked with the youth academies of soccer clubs FC Groningen, PSV and Vitesse. Before and after each training session, players filled out questionnaires about how they felt. In addition, sensors measured, for example, their heart rate and running speed during training. 'Our app can show when a player responds differently to training than we are used to seeing', says Den Hartigh. 'That can be a warning sign that there is an extra risk of getting injured.' Recently, Den Hartigh was invited to share insights from the project at the annual congress for sports coaches. 'Although we now work mostly with soccer clubs, measuring and improving resilience is an important theme across many sports', he says.

The Resilient Athletes project received a Take-off grant of €40,000 from NWO to bring the application built closer to societal applications. Den Hartigh: 'On the one hand, we are going to build the latest science into the app. On the other hand, we are going to investigate which other groups in society can benefit from our app.'

Smart cooling

The Thermo Tokyo project was specifically aimed at optimally preparing the Dutch athletes of the Olympic Games in Tokyo for

How data empower athletes' performance

a combination of temperatures exceeding thirty degrees Celsius with high humidity.

'In total, we measured 130 Olympic and Paralympic athletes in a climate chamber at the Papendal sports centre', says project leader Thijs Eijvogels of the Radboudumc in Nijmegen. 'The first important conclusion was that the performance loss was greater than we expected, up to 25 percent. Many athletes thought in advance that it would not be too bad – they had exercised in warm weather before, they said – but the combination with high humidity really challenged the body to a different level, they had to admit. And the second important conclusion was that there was enormous variation between the athletes.'

The experimental insights were ultimately used to determine each athlete's optimal heat mitigation strategy, for example, by using cooling vests and adopting heat acclimation trajectories. 'Humans originally come from the African savannah climate', says Eijvogels, 'so our bodies can handle heat, but on average, an adjustment period takes ten to fourteen days.'

In the summer of 2021, the researchers were finally able to see whether the athletes benefited from the insights gained and the cooling strategies developed. Eijvogels: 'I saw athletes walking around with cooling vests and thought, "Oh, we tested that one, or that other one turned out to be able to withstand the heat very well." Looking back, we are happy that we were able to contribute to the most successful Olympics of all time for Team NL.'



**We contributed
to the most
successful
Olympics of all
time for Team NL**

More power in the wheels

A Commit2Data project that began after the Tokyo Olympics and ends at this summer's Paris Olympics is WheelPower. Its goal is to ensure that Dutch Paralympic wheelchair athletes put the power of their arms into the movement of the wheelchair as efficiently as possible. 'We have developed an overarching view of five different sports', says project leader Riemer Vegter of the University Medical Center Groningen, 'wheelchair athletics, wheelchair triathlon, wheelchair tennis, wheelchair basketball and wheelchair rugby.'

WheelPower researchers measured the degree to which wheelchair athletes transferred the power in their arms to the movement of the wheelchair during training, competition, and in the lab. 'Based on those insights, we were able to determine what type of training would benefit an athlete the most', Vegter says. 'We also looked at what modifications

to the wheelchair improve performance. For example, some athletes benefit from changing the seat height slightly. And we developed a new hand rim for wheelchair tennis.'

The most important achievement of WheelPower, according to Vegter, lies in the fact that it has succeeded in creating close, structural cooperation on a national level: 'We now have a structural collaboration between four knowledge institutions, NOC*NSF, paralympic sports federations, industry and sports innovation centres. And we are proud that the way WheelPower has connected science with practice has been rewarded with two impact awards, the Tibor Hortobagyi Research Impact Award 2022 and the Societal Relevance Award from research institution SHARE 2023.'



More information
commit2data.nl/en/themes/sport-and-exercise

Looking back

Four organisations were at the basis of the Commit2Data programme. Representatives of these founding partners look back on what has been achieved. What did and did not work out as planned? And which lessons were learnt that could inspire future research and innovation programmes?

By Sonja Knols



René Penning de Vries
(former leader of the top team ICT)

‘Sometime around 2014, I was asked to become the national figurehead and leader of the top team ICT. ICT was not yet a separate top sector at that time, but was named a cross-cutting key technology. My team’s task was ensuring that ICT would be better represented in public-private programmes originating from top sector policy. One of our aims was to set up some large-scale, ICT-oriented innovation programmes that brought together industry, academia and government.

At the time, big data was an emerging field and though some academic groups and companies were already heavily involved in the topic, the work was rather fragmented. With the programme, we wanted to boost this field and align it with the existing initiatives in our country. As a deliberate choice, we divided the programme into vertical pillars following the themes of the top sectors aimed at innovation with ICT, and horizontal lines consisting of data science themes, aimed at innovation in ICT. Looking back, the programme landed on a fertile breeding ground, and the topic of what was then called big data was well-chosen. Commit2Data helped create awareness of the importance of ICT as the innovative power of the other economic sectors. We managed to bring together the right people to work on relevant topics. As a whole, the programme has played an

important part in establishing the foundation on which current-day initiatives like AiNed are built.

Having said that, I would do some things differently with today’s knowledge. For example, every new call’s organisational and approval complexity went at the expense of speed. As a result, Commit2Data has probably been more beneficial to science than to industry.

Besides the speed, the size of such a programme matters if you really want to have a positive impact on innovation in a sector. A programme like Commit2Data was simply too small. All in all, for new programmes explicitly aimed at innovation, I would say: Think big and make choices. Look around, scout for a small set of interesting topics where we as a country can really make the difference, and then go for it with significant investments. It’s better to do one thing right than aim for a hundred targets at once and miss them all. It seems to me that the Growth Fund approach has learnt those lessons.’

and beyond



Yvette Tuin

(former Team leader Mathematics and Computer Science and current Department Manager High Tech Systems at NWO)

'In the entire mix of NWO instruments, Commit2Data was special. From a scientific point of view, there were three main data science themes that had to be connected to the demands of the different top sectors. Every year, we would scout for the most interesting topics that could be addressed in joint calls on the intersections between the three research lines and the nine top sectors. By collaborating with the top sectors and the private parties that were part of them, we could multiply our own public investments.

As a result of this distributed nature of the programme, a large part of the NWO organisation has been involved in it at one time or another. For example, all of the health-related calls landed within ZonMw, whereas the Science domain handled the more fundamental data science subprogrammes, and the calls that were closer to application fell under our Applied and Engineering Sciences domain. This led to some interesting internal exchange of best practices.

However, this choice of organisation did have a downside: it turned out to be hard to form a real overall community. Not only were people working in vastly different sectors, it also did not help that the individual projects started at different times. When

the final call was published in 2020, most of the researchers who had started during the first rounds of projects had already finished.

In hindsight, perhaps we should have organised more programme-wide meetings early in the programme to stimulate cross-fertilisation between the different sectors. On the few occasions we did bring everyone together, the result was some new collaborations among research groups. But when people are not obliged to attend such meetings, something more urgent always comes along.

What I've learnt most from this programme is that for a large-scale initiative to become a success, it is important to define a common goal and find a group of enthusiastic people who want to put in the work. Over the years, there has been a strong continuity in the management of Commit2Data. That has certainly helped in maintaining the focus in the programme. All in all, I would say that a distributed model, as chosen for the Commit2Data programme, can certainly be an option for bringing some focus and mass in emerging fields where there is some promising initial activity, but the existing initiatives are too scattered to make a real impact.'

Looking back



Timon Brussaard

(senior business development manager at TNO)

‘Commit2Data was a very timely initiative to advance the then upcoming field of big data and connect scientific endeavours to the market. The different calls and projects focused on the right topics in relevant sectors like energy, smart industry and health. The programme as a whole was solid and properly funded, and for the researchers involved, there was always a helping hand available when they needed one.

When I joined the programme around the summer of 2018, the first calls had closed and the first projects had started. My focus was to scout for interesting ideas, initiatives and projects that TNO could adopt and bring closer to the market in some form or another. Although I really enjoyed my time within the programme, getting into contact with many nice, enthusiastic and bright people, there was not much for TNO to contribute, and so after a couple of years, I decided to pull out.

Looking back, I feel the programme did not connect enough with the reality of the market. For example, the programme kept talking about big data, while the market had already relabelled the field towards data sharing and artificial intelligence. It is exactly in this market volatility where the programme’s distributed nature could have been used for the best: since new calls were

issued throughout the programme, the later calls could have been somewhat more adjusted to movements in the market. If there were to be a new initiative aimed at developing commercially viable innovations, I would suggest doing a few things differently. First and foremost, I would start from a market-demand perspective, not from a research question. For example, you could include venture capitalists at an early stage to assess the project plans and identify the most interesting routes to explore. And I would seriously contemplate the option of going international and connecting to more application-oriented European projects like ITEA.

Overall, I would say that as a scientific research programme, Commit2Data was a great success. It had the right balance of different subjects and application domains, some really nice next-generation science has been conducted that opened up new windows of opportunity, and the topics that people worked on, like how to clean up data, were timely and on point.’

and beyond



Gerard Goudsmits

(senior policy officer at the Ministry of Economic Affairs and Climate Policy)

'In the mix of public-private initiatives that arose from the top sector policy, Commit2Data was one of the more scientifically oriented programmes. This was probably caused by NWO providing the vast majority of the budget. Companies were mainly asked to participate at the level of calls or individual projects. When I think about this specific programme, the first phrase that comes to mind is: "It's still going strong". The programme is well-led; the people who have been committed to it from the start are still steering it, and, all in all, I think the research funds have been allocated in the right way.

In its mid-term evaluation, the programme concluded that more attention was needed for valorisation. Around that time, I stepped in as a representative from the ministry. Commit2Data had set up a valorisation programme, which included the role of a valorisation coach with a high degree of independence. For us, it was an interesting experiment to see whether such a more tailor-made and intensive form of support could lead to more scientific research start-ups. From the ministry's perspective, stimulating R&D should be linked to valorisation and market creation as much as possible.

What's interesting about this approach is that instead of offering help to existing start-ups, it starts way sooner by scouting topics that might be of interest for commercialisation. Whereas, traditionally, the initiative is left with the researcher involved, here, an expert on commercialisation actively approaches the scientists to point out the possibilities to them for turning their research results into products or services.

The idea of the top sectors was to bring together the triangle of government, industry and academia. The Commit2Data programme embodies this idea rather well. As a ministry, we recently defined new mission-driven key technologies for 2024-2027. Artificial Intelligence and data science are among these. They will clearly profit from the knowledge base that was built and the workforce educated in the Commit2Data programme.

Though the Commit2Data programme may have never made the headlines, I think this is a perfect example of a solid programme working quietly in the background on the right things for our country.'

EARLY DETECTION OF PROGRESSION IN MULTIPLE SCLEROSIS



Med tech company Orikami specialises in applied data science for personalised health care. The algorithm behind its MS Sherpa app enables careful (self-) monitoring of people with Multiple Sclerosis. This allows for a much quicker medication adjustment if needed – possibly saving people from life in a wheelchair. MS Sherpa has now been brought to the market by spin-off company Sherpa and is used in hospitals in the Netherlands, Germany and Belgium.

By Leendert van der Ent

Image Ivar Pel

Orikami has been involved in the Commit2Data project of Lotte Krabbenborg of Radboud University, who investigated the effectiveness and efficiency of self-monitoring-based management of Multiple Sclerosis. Once the barriers to adopting the app Orikami had developed had been researched and the value of MS Sherpa for MS patients was established in clinical research at Amsterdam University Medical Center, Orikami also participated in the adjoining valorisation programme. 'We carried out several smaller projects under that flag with Arie Brouwer's help', says Orikami CEO Bram den Teuling. 'One of these involved a patent application for the way our algorithm translated individual tests into a longitudinal trend by eliminating as much measurement noise as possible. The application was granted, so MS Sherpa is now patented.'

SUBTLE CHANGES

What is MS Sherpa all about? Den Teuling: 'MS is a neurodegenerative disease. The pace of degeneration, which is irreversible, varies. So it's essential to detect changes in a patient's condition as quickly as possible, especially as tens of drugs exist to match an individual patient's need to counter degeneration. Regular monitoring in the hospital is not frequent and accurate enough to quickly detect a rather subtle trend over time. However, smartphone-based self-tests of cognition and walking ability carried out once a week or fortnight with MS Sherpa in combination with the patented algorithm can pick up more subtle changes over time. We believe that for some patients, the use of MS Sherpa and consequential action taken by their healthcare team can mean the difference between needing a wheelchair or not.'

Together with the Erasmus University Institute for Medical Technology Assessment (iMTA) and Amsterdam University Medical Center, the company published a paper about the cost-to-benefit ratio of the app from a financial and quality-of-life perspective. Den Teuling: 'The models clearly show that a timely switch to a second line of medicine can lead to a higher quality of life for the patient. Cost-effectiveness was established across the board, but the solution could even become cost-saving for the healthcare system when it is effective in detecting over 15 percent of the cases that deteriorate early.'

READY FOR ROLLOUT

Den Teuling describes his experience with the Commit2Data projects as both pleasant and efficient. MS Sherpa is now ready for a rapid rollout. Den Teuling: 'Apart from consolidating our position in the Netherlands, Belgium and Germany, a market introduction in the Nordic countries is planned. And after that, expansion to the UK and the USA is also foreseen.'

Dutch Heart Foundation: 'Commit2Data gave us access to the data science world'

'Commit2Data enabled us to get further in big data research than we would have on our own', says Rebecca Abma-Schouten, Manager Research & Health Care Innovation at the Dutch Heart Foundation. Big Data and digitalisation research now have a prominent place in the foundation's research portfolio.

By Leendert van der Ent Image iStock

'Our collaboration with Commit2Data goes back to our 2014-2023 research agenda, which patients, doctors, researchers, donors and volunteers have collectively helped shape', says Abma-Schouten. 'An important place in it was reserved for earlier diagnosis and risk factor detection of cardiovascular disease. For this, big-data-based technological innovation was and still is vital. It was great to join the bigger and broader scope of Commit2Data. The Dutch Heart Foundation alone wouldn't have managed to get us this far.'

That concerns not just finance, she says: 'I also ensured that we gained access to data science networks. Thanks to this, our new research agenda can focus even more on life-saving early detection and intervention. Now, we also address a new aspect: access to care to counter health-care personnel shortages. Our motto is to digitalise where we can, for instance, by self-monitoring.'

Prevention and intervention

Abma-Schouten comments on the four projects that were co-financed under Commit2Data. 'STRAP (Self TRacking for Prevention and diagnosis of heart disease) is a big data and self-measurement project on heart failure in elderly people carried out at Eindhoven University of Technology under the lead of Panos Markopoulos. An e-Health app was developed and tested that focuses on early warning and the role of physical exercise in prevention.'



A second project, Perfect fit, headed by Niels Chavannes at Leiden University Medical Center, focuses on a more effective targeting of risk factors. Abma-Schouten: 'In particular, the power of a personal approach is addressed here by introducing a virtual coach in an app.'

In the third project, MyDigiTwin, Pim van der Harst at University Medical Center Utrecht and fellow researchers create a so-called cardiovascular digital twin. Abma-Schouten: 'A data copy of a person can, thanks to AI algorithms, predict what changes such as quitting smoking or losing weight could mean for someone's

health situation. This helps patients to get better motivated to avert risks.'

CARRIER stands for Coronary ARtery disease: Risk estimations and Interventions for prevention and EaRly detection. André Dekker and his colleagues at Maastricht University created an electronic lifestyle coach that promotes therapy compliance in a risk group. It is the starting point for a personalised lifestyle intervention approach.'

Gather the best

'We expect a lot from these projects', says Abma-Schouten. 'The interdisciplinary collaboration between data scientists, cardiovascular researchers and technologists would probably have been much harder to achieve in an open programme setting. We know the cardiovascular research field, but it has considerable added value that we now also got to know these other specialisations better.'

Another good thing, says Abma-Schouten, is the way projects were organised. 'We prefer not to choose the best from several proposals but rather gather the best specialists in one project.' Commit2Data also opened up the way to additional funding and research capacity from many parties. 'That is very good', she states, 'because there will always be more experts you don't know than who you do know – and we want to keep the first group as small as possible.'

By Leendert van der Ent
Image WAT ontwerpers / iStock

How attention and customisation lead to interest and enthusiasm

Since 2019, 63 academic big data projects have been launched within Commit2Data. The Ministry of Economic Affairs and Climate Policy provided additional funding for valorisation of the research results. As Commit2Data's valorisation coach, Arie Brouwer takes a proactive approach. This innovative approach entuses: three-quarters of the follow-up projects would not have been started without the programme's active attention for valorisation.



‘The challenge for me is to create additional opportunities to follow-up on the research’, says Brouwer. ‘The research programme is very varied, with projects in logistics, health-care, sports, high-tech, culture and agro, among others. For over 40 of the 63 projects, I am now helping with follow-ups. And because of the great variation in content and ideas, there are hardly any standard questions.’

THREE CATEGORIES

Despite the tailor-made nature of the valorisation approach, follow-up steps can roughly be divided into three categories. Some projects require further development or feasibility studies, like when the software works – technical feasibility has been demonstrated in the research environment – but it needs to be made more user-friendly. Such user-friendliness should subsequently be tested in practice. Furthermore, the question of whether the application is commercially viable is usually still open. Brouwer: ‘From many projects, there is interest in such follow-up research towards commercial applications and demos. A €40,000 exploration grant is a nice first step.’

The second type of follow-up step involves hiring expertise. Brouwer gives an example: ‘Researchers want to learn about opportunities in specific foreign markets such as Germany. Especially in medical applications, this is relevant because the medical systems and their funding are completely different in various European countries.’

Fault tree analysis bears fruit

The project Sequoia deploys advanced data analytic techniques on, for instance, the train compressor for the brake system and door opening and shutting, as well as on the climate system to improve the reliability of railway track operation and to reduce the number of disruptions. Years of research with machine learning combined with existing and novel algorithms for fault tree analysis revealed the failure behaviour of railway track elements plus information on the root causes. This enables maintenance and replacement just before failure, thus reducing both planned and unplanned downtime. Mariëlle Stoelinga from the University of Twente: ‘We had the open source software up and running, but that version was not optimised for operational use. The follow-up Commit2Data valorisation project Treefruit allowed us to create user-friendly graphic user interfaces on top of the existing software to make a commercially viable version. We did that with DB TeK, a company that has the software on the market now.’

The third category is the most varied and requires special attention and commitment from Brouwer. ‘For example, some projects may need specific or larger funding for further development. I help with that as well.’

PERSONAL ATTENTION

Overall, the approach is innovative, far more proactive and tailor-made than is usually the case in valorisation. Brouwer: ‘Normally, there is a funding regulation with a website. That’s it. Valorisation with Commit2Data reasons from “a fight for attention”. You have to attract and hold that by giving personal attention yourself. In practice, a quarter of the valorisation projects come about spontaneously. But in three-quarters of the cases, a push was needed by actively drawing attention to the valorisation opportunities.’

So, activating the latent need for application appears to be doubly worthwhile. But ‘attracting attention’ does not sound overly positive. ‘When I started, I actually expected resistance from researchers’, Brouwer acknowledges. ‘They are already busy enough with their teaching and research. Valorisation comes on top of that as an extra burden. Luckily, in practice, researchers hardly see it that way. The vast majority of them like to see their results put into practice. From that attitude, attention fortunately leads to interest. And thanks to customisation and personal attention, enthusiasm can arise. That mainly happens when support can smooth out bumps quickly, transparently and without a lot of red tape – and bumps occur in every project.’

HIGH SCORING RATES

Brouwer believes a fifty to seventy percent chance of success makes it worthwhile to write a proposal. ‘Such a proposal does not necessarily have to be about commercial applications. A societal return in the fields of sports or healthcare is equally valid.’

The innovative approach to valorisation within Commit2Data is working. But isn’t Brouwer ripping into the terrain of technology transfer staff (RTOs and TTOs) within universities? ‘On the contrary’, Brouwer says, ‘we complement each other in collaboration. I am mainly there for the first steps. I like to use their expertise and, in turn, add my own knowledge and skills to their work. Together, you achieve a better result for researchers. That enthuses researchers – and me too.’

A sustainability upgrade of the Dutch energy system

How can weather and climate data be better used to model the energy system? How can energy be saved in greenhouses by taking advantage of the resilience of plants? And how can the flexibility of supply and demand on the electricity grid be better predicted and used? These are three examples of research questions that have been investigated within the Commit2Data research theme Energy.

By Bennie Mols
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The transition from oil and gas to sustainable energy sources, such as sun and wind, poses new challenges for the Dutch energy sector. Energy generation is becoming more decentralised, the availability of energy is becoming more unpredictable, and the demand for electricity is increasing rapidly. To meet these challenges, management and control based on data is crucial.

Plants as batteries

Greenhouse horticulture accounts for ten percent of the gas used each year in the Netherlands. In the Commit2Data Flexcrop project, scientists investigated whether energy consumption could be reduced by using the plants in the greenhouse as a kind of battery: charge the battery – by using more light and warmth in the greenhouse – when energy is cheap and sustainable and let the battery drain – by using less light and warmth – when energy is expensive and unsustainable.

‘We looked at the extent to which tomato plants can withstand fluctuations in temperature and light in the greenhouse’, says project leader Simon van Mourik of Wageningen University & Research. ‘To give an idea: we are talking about temperature variations of about three degrees and light variations of up to thirty percent.’

In their laboratory greenhouse, small tomato plants were surprisingly resilient. Van Mourik: ‘The total growth was approximately



equal to that of plants growing under a non-fluctuating climate. That is positive, but it is only a start. We still have to investigate the fruit production and seed quality. The most sensitive process is what determines which fluctuations are allowed.'

Van Mourik's vision is to let biology and ecology do their work as much as possible as part of the energy transition in greenhouses. 'We now have greenhouses with extreme control. There is no resilience, while something like a natural forest is very resilient to changing circumstances. By linking biology to more intelligent and adaptive technology, I hope we can use plants' resilience to make greenhouses more energy efficient. Flexcrop is a first step in this direction.'

Better prepared with weather data

Transmission system operators, such as TenneT in the Netherlands, use power system models to evaluate whether the power system can always fulfil all the electricity demand. However, with a growing number of wind turbines and solar panels, the electricity supply will become increasingly dependent on variations in weather and climate. The project ACDC-ESM (Algorithmic Computing and Data-mining for Climate integrated Energy System Models) aims to speed up the algorithms underlying energy system models, of which power system models are a part. Weather data were used to evaluate whether the system remains adequate during multiple years of fluctuating weather.

'These models are computationally very intensive', states project leader Machteld van den Broek from Delft University of Technology, 'and the electricity demand and weather data have a high spatial and temporal resolution. We looked at how to deal with the large amount of data and ways to speed up the computational models. On the data side, we have found several efficient ways to identify extreme weather events. On the algorithms side, we have achieved an acceleration. And at the modelling level, we have explored how much detail you need to include in practice.'

With improved Energy System Models, various parties in the energy sector will be able to take more informed decisions. Van den Broek elaborates: 'How much do we need to invest in storage and what type of storage? Do we need to invest in transmission with other countries? Is it more cost-effective to switch off wind farms than to store the electricity? Last year, one of our PhD students was hired as a data scientist by TenneT, so he will use some of our results in practice.'

Taking advantage of flexibility

Where weather is an externality that no one can change, energy demand is something consumers can partly influence. For example, electric car drivers can choose what time of the day they charge their car. 'In the Energy Intranets project, we explored how to use various forms of flexibility to contribute to keeping the electricity grid stable', says project leader Eric Pauwels from Centrum Wiskunde & Informatica in Amsterdam.

Based on factors such as the expected electricity prices over the next 24 hours and the flexibility in the demand for electricity when charging electric cars, researchers of the Energy Intranets project calculated an optimal charging schedule. Pauwels: 'Together with the start-up company Sympower, we have also tested this optimisation method in practice.'

A second important project result is in the area of electricity generated by solar panels. 'We tried to predict the fluctuations in a system with a lot of energy generated by solar panels', Pauwels says. 'When just a few clouds drift by, the electricity output drops rapidly. That can cause significant fluctuations in the electricity grid. We have developed techniques to improve the prediction of those fluctuations.'

A third line of research examined how to compute steady-state solutions in systems where networks with very different physical properties interact. Pauwels: 'When you construct models that link the transmission to the distribution grid, or heat networks to the electricity grid, you create huge systems of equations with very different characteristics. It is incredibly hard to solve such heterogeneous equations. Our researchers are developing efficient and accurate numerical techniques to tackle these mathematical challenges. Having timely access to accurate steady-state solutions is important for planning and control in such networks.'



More information
commit2data.nl/en/themes/energy



Paul Havinga supervises three Commit2Data projects. In DataRel, he and his colleagues researched systems that predict emerging behaviour and minimise delays in logistics. In Smart Connected Bikes, the goal is to research, design and evaluate a system that combines sensing, wireless technology and data science to make bicycling safer and more comfortable. And in the project The Youngsters, Havinga and colleagues investigate ways to monitor the health of young farm animals remotely.

Improving impact on society

The private and public sector can and should learn from each other for the benefit of all society, says Paul Havinga, who is both Professor of Pervasive Systems at the University of Twente and Principal Scientist at TNO – ISP. He leads three Commit2Data projects.

By **Marysa van den Berg** Image Gijs van Ouwkerk

'I have combined working for the private and public sectors for at least five years. So, I am involved in both ways of thinking. And I know how hard it can be to have a good interaction between the two. We both must invest to make it work, but then we will get really nice results.'

Take the Commit2Data project DataREL as an example. In this project, we tried to design smart systems that can predict delays in transport, which could otherwise have a huge negative impact on the entire logistics. Getting into the real world and a bit away from perfect simulations allows you to get the insight that is needed. A lot of data comes from sensors. When these provide data that is incorrect, the consequences can be horrendous.

To get it right, the companies involved had to share their real-life data, but they were reluctant to do so as it is confidential information. Therefore, at the University of Twente, we designed methods and a framework that allowed them to securely share data, which allowed us to develop new services and insights. So, it works both ways.'

No ivory tower

'As a university, we need to look further into the future than companies. When I talk to our private partners, I never tell them we developed a very nice method; do you want to use it? No, I always ask what their problems and main bottlenecks are. This allows us to get inspiration for our research, leading to a new direction that ultimately benefits society.'

I am convinced there should be more interaction between academia and the private sector. That should also lead to companies getting the insight that people from academia are not just sitting in an ivory tower but can actually help with longer-term challenges.

Two of the Commit2Data projects that I participated in recently were awarded Take-off grants. This also indicates that successful cooperation between academia and industry can lead to great results with potential benefits for society.'