Nieuwe technologie
mogelijk maken

Maps4Society

solutions for user-oriented and smart geo-information infrastructure

Programme Plan

Co-operation Programme
STW-Rijkswaterstaat-Kadaster-NSO-NCG

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Nederlandse Organisatie voor Wetenschappelijk Onderzoek

Ministerie van Economische Zaken

Table of Contents

Table of Contents 1

1. Introduction and Industrial Relevance 2
   - Cooperation 2
   - Relevance for top tier sectors (topsectoren) 2
   - Background 3
   - Industrial relevance and participation 4

2. Focus and applications 5
   - Focus 5
   - Applications 5

3. Geo-information research areas 6

4. Link between geo-information research areas and applications 8

5. Research project proposals 8

6. Unique character of the programme 9

7. Duration, budget and utilisation 9
   - Utilisation programme 10

8. Programme Committee and Advisory Board 10

9. Special conditions for applicants 11

Appendix 1. List of abbreviations 12

Appendix 2. List of letters of support 13

1. Introduction and Industrial Relevance

Cooperation

The Dutch technology foundation (STW) initiated the STW Cooperation Programme to stimulate effective cooperation between academics and societal partners. In the context of this programme the Rijkswaterstaat, the Kadaster, the Netherlands Space Office (NSO) and the Netherlands Geodetic Commission (NCG) together with universities and companies, have developed the Maps4Society (M4S) research proposal. The core of this proposal is user-oriented geo-information innovation and research on smart geo-information infrastructures. A key utilisation area for this programme is *object life cycle management.*
The cooperation is supported and initiated by the ICT Innovation Platform Geo (IIPGeo) and the NCG, and is developed in close cooperation with the geo-information professional domain (amongst other things via a workshop in September 2012 and a special utilisation workshop for companies in March 2013; reports on www.maps4science.nl).
The M4S programme fits in well with the national policy on geo-information (GIDEON), of which a proposal for the second phase is currently being formulated. This policy stimulates a close cooperation between the government, companies and knowledge institutions. The M4S programme will be connected with the ICT Breakthrough projects "Open (geo)data as a component for growth and innovation" (including ODIN), "Digivaardige Beroepsbevolking" [European Competence Framework] and "the Digital Delta".
M4S aligns with the Lobby Agenda 2013-2014 for GeoBusiness Nederland (GBN), spearheaded by open innovation and the role of geo-information in the 'topsectors'.
M4S's goal is to innovate components of the existing national geo-information infrastructure, such as the "Nationaal Modellen en Data Centrum" (NMDC)", the "Publieke Dienstverlening op de Kaart (PDOK)", and the national Satellite Data Portal. This will be done in alignment with international developments, such as the EU FP7 project European Location Framework (ELF), which supports the usability of the European INSPIRE Directive and the EU FP7 project Virtual Construction for Roads (V-Con), which focuses on standardisation and implementation of Building Information Modelling (BIM) technology. This cooperation programme addresses several themes of the grand challenges of Europe (identified in Horizon 2020).

Relevance for top tier sectors (topsectoren)

The M4S programme will contribute to various ambitions, themes and programmes of the Dutch 'topsectors'.

Roadmap ICT - As indicated in the 'Advice of Topteam High Tech Systems and Materials' (June 2011), ICT is an enabler for all 'topsectors'. Maps4Society fits well in the ICT Roadmap, and is especially connected to the topics "ICT for a connected world" and "Data, data, data". Big data is an important theme addressed by the Roadmap ICT.

High Tech Systems and Materials - The 'innovation contract HTSM 2012' states that a structural increase of HTSM-relevant university research will be necessary in order to fulfil the ambitions conceived for this 'topsector'. The research proposed by M4S will contribute to:

- Roadmap Automotive: Smart Mobility requires that huge amounts of data from various sources with different accuracy and reliability need to be combined. This will be addressed by the M4S research areas 'Dynamic data and harmonisation' and 'handling Big Data'.
- Roadmap healthcare systems require extensive data sharing, interoperability and fast extraction of the right information from very large databases of different origin.
- Roadmap embedded systems: problems (research areas) related to distributed sensor systems include distributed processing; scalability, uncertainty, dynamics and processing of distributed, unreliable data.
- Roadmap Space: downstream use of geo-information from space technology.

Logistics – for this 'topsector' it's of major importance that the flow of data correct. It is difficult to achieve this because of the many data sources from various owners, the unpredictability of the data and the increase in data which is individualised. In order to optimise scheduling of (various forms of) transport, advanced research is needed. This will partially be provided by M4S.

Topsector Energy - In order for the Smart Energy Grid to work in real life, the stochastic aspects in its management will have to be studied. The statistical techniques evolved for working with geo-oriented data and further developed in the research area 'data quality assessment' of M4S, can be helpful.

Creative Industries

- ICT and Media require new ways to search and access open and closed data.
- Architecture and the built environment has an interest in open data and standardisation.
- Cultural heritage needs standardisation of metadata, data mining, semantic interoperability and visualisation of large data sets.

Water

- Delta technology: Digital Delta; 'Duurzame Deltasteden' [sustainable Delta cities – Mapping & Monitoring]
- Water technology: Water & ICT
- Maritime: smart ships and smart ports

In particular for the Digital Delta (project within Topsector Water & Breakthrough project on ICT), we see the following opportunities:

1) Big Data en Smart analytics: better sharing of information in the Dutch water sector opens the opportunity for new analyse methods and techniques
2) Research of the interoperability between water-ICT applications/platforms and smart Geo-information infrastructures.

Background

Many processes in our living environment have a location-specific impact. Examples of this are traffic congestion, the spread of infectious diseases, food production, housing transactions and floods. Spatial information is a key asset for the monitoring and management of these processes. More often this information is organised in and provided by geo-information infrastructures (GII). Collaboration between GI providers and users is crucial for the development of a healthy and innovative geo-information infrastructure. Rijkswaterstaat, the Kadaster and the NSO are key providers of Dutch geo-information. They play a central role in the development of a national GII.
Rijkswaterstaat is the executive arm of the Dutch Ministry of Infrastructure and the Environment (I&M). On behalf of the Minister and State Secretary, it is responsible for the design, construction, management and maintenance of the main infrastructure facilities in the Netherlands such as the national waterways and roads infrastructure. It facilitates the smooth and safe flow of traffic, keeps the national waterway system safe, clean and user-friendly, and protects the country against floods. Geo-information plays a crucial role in the various activities.
The Netherlands' Cadastre, Land Registry and Mapping Agency, in short *Kadaster*, is an independent governing body, under the political responsibility of the Minister of I&M. The Kadaster collects and registers administrative and spatial data of property and the rights involved. This also includes ships, aircraft and telecommunication networks. The Kadaster also maintains the Key Register Cadastre and Topography and is a node for e-government. Rijkswaterstaat and the Kadaster together, are responsible for the maintenance of the national reference coordinate system: Rijkswaterstaat for the vertical reference via NAP (Amsterdam Ordnance Datum), the Kadaster for the horizontal reference via the RD system (national triangulation system).
The *NSO* was established by the Dutch government in October 2009, to develop the Netherlands' space programme and to activate that programme. Since March 2012, the NSO has been operating the Satellite Data Portal, which provides Dutch users with free access to current, raw satellite data from the Netherlands.
The *NCG* coordinates and initiates fundamental and strategic research in geodesy and geo-information in the Netherlands. The NCG advises on general policy issues related to geodesy and geo-information, stimulates the spread of knowledge in these fields and coordinates the geodetic infrastructure of the Netherlands.
The Netherlands is historically one of the world's best-measured countries. It continues this tradition today with unparalleled new datasets, such as the nationwide large-scale topographic map, the unique digital height map (nationwide coverage; ten very accurate 3-D points for every square metre of the Netherlands), and a range of public and private collections of environmental and socio-economic geo-datasets. The focus of this programme is to create societal and economic value from the geo-data through innovative research.

Industrial relevance and participation

In the last few decades a vibrant geo-information industry has materialised in the Netherlands. Most GI jobs are now in the industrial sector which has organised itself under the umbrella of GeoBusiness Nederland. It is also a highly innovative sector with about 7% of its turnover invested in R&D (ref. Marktmonitor GeoBusiness Nederland). Continuous innovation is therefore essential to maintain the position of the Dutch GI industry as a world leader in geo-information knowledge, high quality geo-data and innovative applications. During the past decade a large part of the data has become available as open data in the Netherlands (and it is expected that this will increase further). This has offered and continues to offer ample opportunities for the private sector, in sound cooperation with government and universities, to develop value-adding products and applications. The GI industry, through its trade organisation GeoBusiness Nederland (GBN), has expressed its support for the Maps4Society programme. Of particular relevance is the 'innovatiecommissie GBN' (the innovation committee of the GI industry). In this committee Maps4Science is labelled as the main anchor programme for future innovation and collaboration with the government and universities/knowledge institutions. It is envisaged that GBN will be a permanent member of the M4S advisory board (see section 8).
Synergy will be established with the participation of GBN in the High Level Group and steering committee of the ICT Breakthrough project ODIN. Active participation of the GI industry is envisaged in various phases of the programme:

1) Initiation phase: during the formulation of the programme GBN and associated companies were actively involved via workshops.
2) Execution phase: companies participate in the various Maps4Society research projects. Within each project, participation by a company is required. Its contribution can be in cash or in kind. Match-making workshop(s) will be organised.
3) Utilisation phase: When new and innovative methods, techniques and applications are developed within this programme, it is the role of companies to utilise them in order to create value adding products.

The utilisation workshop had a positive vibe and showed serious interest in participation by companies in Maps4Society projects, as is illustrated in the letters of support (list appended).

Figure 1. Utilisation workshop 15 March 2013, GBN Woerden

2. Focus and applications

Focus

We are witnessing an ongoing transition of the geo-information role from the old “map paradigm” (describing a spatial situation) towards continuous identification, monitoring and control of spatial processes at multiple scales. This transition requires a change in our geo-information production processes: from a traditional, linear process to a cyclic and more integrated approach (see Figure 2).

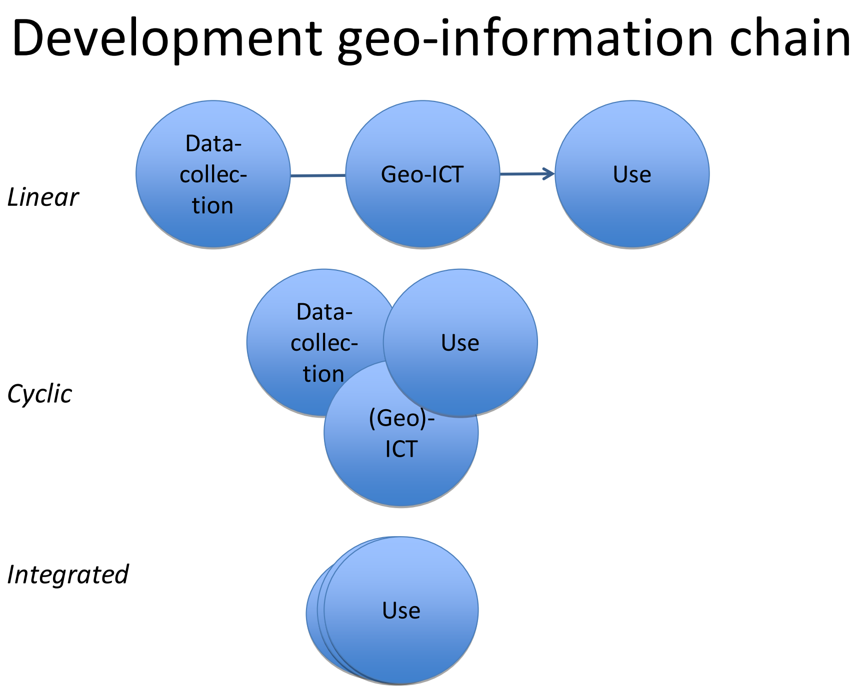

Figure 2. The development of the geo-information chain, from a linear chain towards a cyclic and more integrated approach.

In the past, the geo-information production chain was a linear process in which geodata was collected, and subsequently stored, analysed and used. The use was mainly by geo-information specialists. During the last decade, the geo-information process has become more cyclic, with more user influence and a wider spectrum of applications. At the same time, geo-information users are becoming data producers, for example, by updating the traffic information for TomTom or contributing to the Open Street Map (OSM).
In data collection, there is a growing importance of (geo)sensors. In the future, we expect the development of an integrated geo-information production chain, which displays a smart, data-intensive and dynamic geo-information infrastructure with intensive interaction with users.

Applications

Results of the proposed M4S programme will be applied to the object life cycle management of buildings and infrastructure constructions. Research will also stimulate the further development of PDOK, NMDC, and the Satellite Data Portal. It is envisaged that research will be applied in a number of cases which are highly user-oriented, as defined by the M4S consortium partners:

1. *Object life cycle management for building and infrastructure.* Here the focus lies on the framework for interoperability of ICT systems in the supply chain (eBSN). Instead of separate solutions for the different

phases in the building process, an object-oriented information architecture is urgently required, in which objects can be represented throughout their lifecycle in combination with GI and spatial information.
Issues are: (1) harmonising of different data semantics between objects, phases, and other (geo-)information sources (topography, cadastre), and (2) managing and disseminating data between stakeholders.

2. *Water management.* This provides a link with the “Digital Delta” and the ‘topsector’ for water. This enables the urgently needed exchange of knowledge between the ICT-driven developments and the GI-driven developments.
Issues are: (1) the combination of different types of data like large-scale topographic base maps (3-D), high-density point cloud data (laser scanning), satellite data, and real-time sensor data for water management and, (2) the combination of data with spatial process models for analyses and prediction.
3. *Deformation and change monitoring.* Deformation is an issue of continuous concern in the Netherlands. Besides deformations of the Earth’s surface itself, deformations of buildings and physical infrastructure like dykes, roads, and railways (continuously) have to be monitored. Even small deformations can, in the long term, have a huge impact. If deformations of physical infrastructures are not detected in time this can lead to high maintenance costs. *Issues are:* (1) the processing of raw (radar) satellite data to derive deformation information, (2) mobile mapping techniques (sensors on vehicles, trains and ships) and unmanned aircraft systems (UAS).
4. *Crisis management.* Crisis management is a complicated process that involves various phases (mitigation, response, recovery, etc.), and many different parties (various kinds of rescue workers, authorities at different levels, civil protection, the Red Cross, military, etc.).
Issues are: (1) net-centric activities i.e. relevant information (including smartphone crowd-sourcing) should be processed and be made readily available in real-time at the right level to all the participants involved in the management of emergency services, (2) 3-D modelling, positioning and navigation with specific attention to dynamic environment and indoor/outdoor integration.
5. *Smart Cities/Human environment.* The Smart Cities concept endeavours to find smart solutions to complicated urban problems in areas such as energy, transport, governance, societal change, pollution, management of high traffic densities and the movement of masses. In monitoring our human environment, both the physical and social aspects are among the key activities for Smart City decision-making.
Issues are: (1) Citizen involvement in the development of new urban planning policies being relevant for a transition to co-creation mechanisms. (2) GII technologies (including positioning, sensor-web) to instrument Smart Cities with their ‘nervous system’.

3. Geo-information research areas

In support of the abovementioned applications, a number of geo-information research areas have been identified. The proposed areas are based on the formulated research agendas of the NCG-KNAW, and a Map4Society workshop amongst the participants.

A. *Dynamic data and harmonisation.* The geo-information domain is shifting from static 2-D geo-data towards dynamic 3-D data collection, processing, integration and use. In many applications, data from heterogeneous sources (different domain models and terminology used) must be combined. From a governance point of view we recognise spatial processes at different aggregation levels that require management at different administrative levels, this requires consistency of spatial-temporal data at different scale levels. This shift requires a re-design of our geo-information infrastructure and the associated data entry and use procedures. Information models (with explicit meaning based on semantic technology) should be formalised based on agreed principles for object IDs, object life cycle, multi-source object referencing, time, scale, etc.
Research questions: (1) How does one realise concepts such as multi-scale and vario-scale geo-information? (2) How does one provide data harmonisation services in a dynamic GII setting?
B. *Handling of Big Data.* Within the domain of geo-information very large spatial-temporal datasets are produced: satellite data (see D), massive crowd-sourced data (see E), massive point clouds (such as LiDAR or multibeam echosounders).These cover aspects such as atmosphere (weather, climate and air quality), water (water levels/quantity, water quality and storms), subsurface (geology, groundwater flow quantity and

quality), and human behaviour (traffic flow and population health). In the handling of these very large datasets it has become a challenge to make them timeously available and useful for applications. *Research questions:* (1) How does one manage the continuous updates of large dynamic datasets (permanent data flows)? (2) What is the best way to manage these and to process large geo-datasets (efficiently and effectively), and how can information be retrieved and visualised from these datasets?

C. *Data quality assessment*. An important aspect of working with geographic datasets and particularly working with reference datasets, is the (perceived) quality of the data and the means to assess its quality. In the last decade a transition has taken place from data-oriented quality towards user-oriented quality. More and more data is integrated by using geo-information infrastructures. The quality of the integrated products (both the information and the results of process simulation models) is becoming an issue of concern.
   Research questions: (1) How can the quality of spatial data be assessed and presented in a user-oriented context? (2) How can the quality of an integrated geo-information product be assessed?

D. *Satellites-as-a-service.* The increased use and importance of satellite data has led to more time-driven user requirements. Instead of ordering readily available data products from a satellite operator and applying these products some days to weeks after the actual acquisition, users have a need for real-time and on-demand programming, acquisition and delivery. Solutions are expected to be based on the principle 'satellites-as-a-service'. *Research questions:* (1) How does one realise new concepts and techniques for "satellites-as-a-service"? (2) How can companies and citizens benefit from satellites-as-a-service" applications?

E. *Volunteered geographic information.* VGI (including trajectory data) has obvious potential for the collection of geo-information but also comes with yet unresolved problems. This type of data is prone to errors and it's difficult to assess the reliability and trustworthiness of the derived results. The role of VGI can be manifold: (a) it can be used as a ground truth for verification purposes, (b) it can also be used as a raw data source for spatial phenomena for which no alternative survey methods currently exist, and (c) for charting the stakes/desires of various stakeholders. *Research questions*: (1) How can VGI be used in combination with "professionally acquired" data? (2) What quality of VGI is required for specific application areas?

F. *Geo-information infrastructure governance.* Besides technical facilities, legal, organizational, financial, strategic and data policy issues play a key role in the actual access and use possibilities of data. A well-functioning and trustworthy infrastructure can only be achieved if clear policies are formulated and implemented. Data policies play a key role and use restrictions (if any) must be respected and/or enforced in the geo-information infrastructure. For enforcing certain use restriction technical as well as legal solutions can be used. It is the ambition of the Maps4Society consortium to formulate, implement and evaluate a data policy (and strategy) and an organizational framework that on the one hand respects ownership, responsibilities and privacy aspects of the data and at the other hand stimulates innovation and creative use and cooperation. The geo-information infrastructure is not a fixed reality, but the outcome of a process in which different (mutually dependent) stakeholders, namely public, semi-public and private actors, interact, share information and negotiate with each other in the policy arena to optimize the potential of geo-data. One should for example consider the existing information monopolies. For that reason the geo-information infrastructure is not primary a technical challenge ('technology driven' effort), but a political and strategic issue as well. For that reason the intended and unintended effects of the geo-information infrastructure should get attention too. The governance approach of the infrastructure has also implications for steering relations (based on mutual trust, horizontal interactions, co-creation and creating common images about the perceived reality). Finally, the geo-information infrastructure is becoming more 'bi-directional' (e.g. crowd sourcing') and can have societal implications as well, for example in terms of involvement of citizens and users of geo-data . It is very important that attention should be given to the needs, rights and responsibilities of citizens involved in the creation and use of geo-data.
   Research questions: (1) Which organizational and governance structures need to be implemented for a sound and innovative geo-information infrastructure? (2) How can effective safeguards be put in place to deal with the needs, (privacy) rights and responsibilities of citizens involved in the creation and use of geo-data in an integrated geo-information infrastructure?

4. Link between geo-information research areas and applications

Within the cooperation programme applications are linked with the geo-information research areas.

Table 1. Relationship between applications and research areas

Research Areas	Applications				
	Object life cycle management	Water management	Deformation monitoring	Crisis management	Smart cities / Human environment
Dynamic data and harmonisation					
Managing Big Data					
Data quality assessment					
Satellites-as-a-service					
Volunteered geographic information					
Geo-information infrastructure governance					

Within this cooperation programme *research project proposals* will be offered that combine a geo-information research area and one or more application domains (addressing at least one and preferably more cells in table 1).

In the utilisation workshop it seemed that 3 or more cross-overs in the matrix are relevant for almost every company, depending on the focus of the company (data acquisition, geo-ICT, services, etc.), so the matrix suits the business needs for innovation very well.

5. Research project proposals

The following criteria are defined for project proposals within the Maps4Society programme:

- The project proposals should address at least one of the application areas as mentioned in section 2 by advancing one or more of the major research areas as mentioned in section 3.
- Projects should be submitted by at least two research groups from different universities or scientific disciplines.
- Projects should be multiparty projects, including science, governance and companies (the government and the business community can participate “in kind”).
- Projects should contribute significantly towards the development of an integrated geo-information process chain.

Exclusions from this programme are project proposals covering:

- Research and development on the basis of existing patents that are not owned by the university applicants themselves.
- Research topics on which there is a conflict of interest with one of the participants.

6. Unique character of the programme

- The programme is unique in a sense that the Rijkswaterstaat, Kadaster, NSO, NCG, companies and universities work closely together on common scientific, economic, and societal issues.
- It contributes significantly towards the improvement of the existing National Geo-Information Infrastructure via various innovations, and the realisation of (one of) the most advanced geo-information infrastructures in the world. This infrastructure will stimulate innovation spill-overs between sectors.
- It strengthens the Dutch scientific community in its role of geo-information infrastructure management and its deployment for actual societal themes.
- It contributes towards maintaining the competitive edge and is advantageous for GeoBusiness Nederland (GBN) within the international geo-business arena.

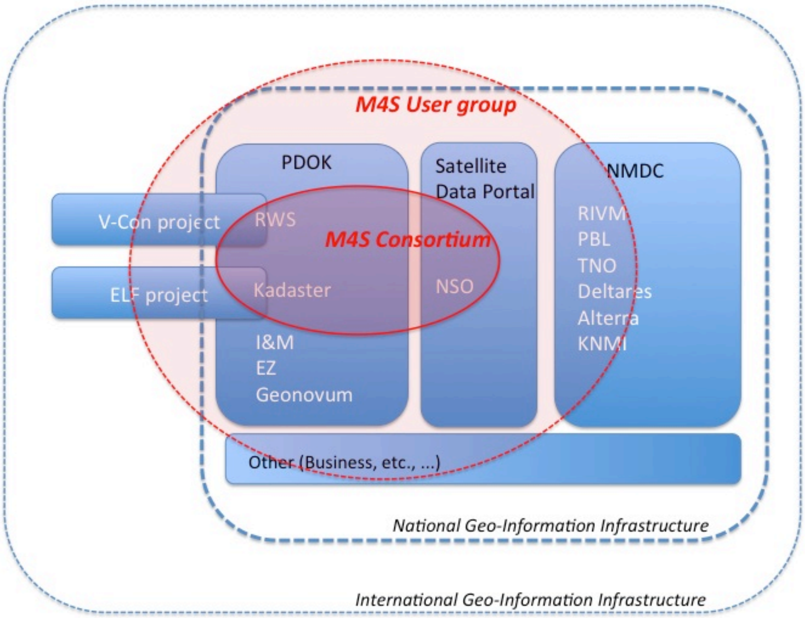

Figure 3. M4S Consortium and M4S User Group in the context of the (Inter)National Geo-Information Infrastructure.

7. Duration, budget and utilisation

The proposed duration of the programme is 6 years. The planning: 2013 preparation phase, 2014-2019 execution phase, 2020 anchoring phase.

The total budget is €3 million, of which 50% is funded by STW and 50% by the Maps4Society partners. The budget is shared by the partners in the Maps4Society consortium as follows: Rijkswaterstaat 88.5%, Kadaster 5%, NSO 5%, NCG 1.5%.
In addition, there will be a substantial in-kind participation from the consortium partners and other users involved in the projects (see Figure 2). Various parties have already confirmed their intention towards in-kind participation in projects, e.g. Esri, Fugro, Neo, Geonovum, and NMDC.

Utilisation programme

To stimulate the development of value-adding products and applications, a knowledge and utilisation programme will be set up. Knowledge, development and application will be brought together in meet-and-match sessions. Consequently R&D spending will be converted into the commercialisation of services and products. To create a learning community for knowledge dissemination and for the anchoring of results, a Maps4Society User Group will be formed, with a clear link to existing user panels and platforms like IIPGeo, IIPBouw and IIP Sensor networks. Utilisation and co-creation is stimulated by this M4S User Group. If needed, the individual projects will be supported by an individual user-reflection group (see Figure 2). A minimum budget of 10% will be apportioned to the utilisation programme. Besides that, as a responsibility of the project, 10% of the project budget must be allocated for knowledge dissemination and utilisation.

8. Programme Committee and Advisory Board

Rijkswaterstaat acts as leading party for the Maps4Society consortium. The programme will be managed by a programme committee (PC) consisting of 10 people, comprising five representatives from practice, nominated by the Maps4Society consortium (M4S members) and five scientists representing STW.

The PC Members representing the Maps4Society consortium are:
- Kyra van Onselen PhD, Rijkswaterstaat – GI:, Sr. Advisor
- Andreas Heutink MSc, Rijkswaterstaat – Building Information Model (BIM):, Sr. Advisor on innovation & development
- Aart-Jan Klijnjan, Kadaster , Head of Policy and Development
- Jasper van Loon PhD, NSO Advisor science and applications
- Prof. Martien Molenaar, NCG Chairman

The five scientific PC Members representing STW are:
- Prof. Alan Hanjalic, TU Delft (hardware/ICT)
- Prof. Kees Stuurman, University of Tilburg (legal)
- Hylke van Dijk, NHL (serious gaming)
- Rene van Schaik, NLeSC (Netherlands eScience Center) (Big Data, visualisation)
- Prof. Yola Georgiadou, UT, ITC (social sciences).

Kyra van Onselen will chair the PC.

The members of the Programme Committee (PC) have the expertise to assess the proposals. The PC comprises people from the fields of both geo-information and ICT; participation from the ICT field is provided by the STW scientific expert candidates. PC members may invite advisory members to the PC meetings, although they will not have any voting rights.

A permanent Advisory Board (AB) plays a key role with regard to the utilisation and may also be involved in reviewing the proposals. Candidates will be sought from organizations such as:
- GeoBusiness Nederland (GBN)
- Geonovum
- Nationaal Modellen en Data Centrum (NMDC))

- Centre for Public Innovation (CPI)
- Digital Delta (top tier sector Water)
- ICT Roadmap (top tier sector HTSM).

The PC is responsible for the overall strategy and management of the programme. The PC meetings will be organised/planned twice a year unless the PC decides otherwise. All members of the PC are subjected to confidentiality restrictions to protect any ideas set down in the university project proposals.
STW shall appoint a Programme Manager for organisational assistance to the PC. This Programme Manager has no voting rights in the PC and will not be remunerated from the project funds. Coordination of the utilisation programme will be provided by IIPGeo in cooperation with others, if necessary.

9. Special conditions for applicants

Universities and institutions that qualify, may apply on the basis of the STW criteria.

Appendix 1. List of abbreviations

BIR	Bouw Informatie Raad [Building Information Council]
CPI	Centre for Public Innovation
ELF	European Location Framework
EU FP7	European Framework Programme 7
EZ	Dutch Ministry of Economic Affairs
GBN	GeoBusiness Netherlands
Geonovum	National SDI executive committee
GI	Geo-information
GII	Geo-information infrastructure
GIDEON	National policy on geo-information
GPS	Global Positioning System
HTSM	High Tech Systems and Materials (‘topsector’)
IAP	ESA International integrated & telecommunications applications
ICT	Information and Communication Technology
IIPBouw	ICT Innovation Platform Buildings
IIPGeo	ICT Innovation Platform Geo
IIPSensor	ICT Innovation Platform Sensor networks
I&M	Dutch Ministry of Infrastructure and the Environment
INSPIRE	Infrastructure for Spatial Information in the European Community
KNAW	Royal Netherlands Academy of Arts and Sciences
KNMI	Royal Dutch Meteorological Institute
LiDAR	LIght Detection and Ranging (an optical remote sensing technology that can measure the distance to an object)
M4S	Maps4Society
NAP	Normaal Amsterdams Peil [Amsterdam Ordnance Datum]
NCG	Netherlands Geodetic Commission
NMDC	Nationaal Modellen en Data Centrum [National Models and Data Centre; cooperation between 6 Dutch organisations]
NSDI	National Spatial Data Infrastructure
NSO	Netherlands Space Office
ODIN	Open (Geo) Data Innovation Network [Open Data Innovation Network; one of the ICT breakthrough projects as formulated by the Dutch Government]
OSM	Open Street Map
PBL	Netherlands Environmental Assessment Agency
PC	Programme Committee (of the cooperation programme)
PDOK	Publieke Dienstverlening op de Kaart (central facility for providing access to geodatasets of national importance)
RD	Rijksdriehoeksmeting (Dutch national horizontal reference system [national triangulation system])
RLI	Raad voor de Leefomgeving en Infrastructuur [council for the environment and infrastructure]
SDI	Spatial Data Infrastructure
STW	Dutch technology foundation
TNO	Netherlands Organisation for Applied Scientific Research
V-Con	Virtual Construction for Roads
VGI	Volunteered Geo-Information (by citizens)

Appendix 2. List of letters of support

Below is a list of organisations that have expressed support in writing for this programme and the previous Maps4Science initiative.

Alterra, Wageningen UR
COMMIT, ICT Roadmap
Data Archiving and Networked Services (DANS)
Dutch Ministry of Economic Affairs
Dutch Ministry of Infrastructure and the Environment (I&M)
Erasmus Universiteit Rotterdam
Esri Nederland
Fugro GeoServices B.V.
GeoBusiness Nederland
Geodan B.V.
Geonovum
Google
Hansje Brinker B.V.
HAS Hogeschool
Nationaal Modellen- en Data Centrum (NMDC)
Netherlands Geomatics & Earth Observation B.V. (NEO)
Nieuwland Geo-Information
Oracle
Topsector ICT / COMMIT
Topsector Water
Witteveen+Bos Raadgevende ingenieurs B.V.

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