Case study TKI Maritime

A strategic public-private partnership for the Dutch maritime sector

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Rathenau Instituut

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Preface

Public-private partnerships are an increasingly prominent vehicle for governments and industry to stimulate research and innovation. With a view to international cooperation in this area, the working party on Innovation and Technology Policy of the Organisation for Economic Cooperation and Development (OECD) has set the ambition to propose a common framework for the design and evaluation of public-private partnerships in science, technology and innovation. This initiative is in line with the recommendation the Rathenau Instituut made in 2013 to strengthen the learning capacity with regard to public-private research[1].

To this end, the OECD has set up a project to identify trends and good practices for strategic public-private partnerships. The current report has been written to provide input to this project by describing in detail the governance and functioning of TKI Maritime, one of the 19 Top consortia for Knowledge and Innovation that have been set up in the context of the Dutch top sector policy.
The report shows how TKI Maritime uses different collaboration modalities for each stage of the knowledge and innovation chain. Based on a combination of funding sources and using a light governance structure building on previous relationships, TKI Maritime ensures industry is committed to playing an active role in programming, co-funding and executing research and innovation projects. At the same time TKI Maritime is able to encourage researchers to align their fundamental work with the TKI's innovation agenda.

This report is a co-production of the Rathenau Instituut and the Dutch Ministry of Economic Affairs.

Dr. Barend van der Meulen
Head of department Science System Assessment, Rathenau Instituut

[1] Coördinatie van publiek-privaat onderzoek: van variëteit naar maatwerk, Rathenau Instituut, 2013

Summary

The ‘Top consortium Knowledge & Innovation Maritime’ (*TKI Maritiem*) was set up in 2011 as a vehicle for structural public-private collaboration in research, development and innovation in the Dutch maritime sector. It is one of 19 TKIs that were launched as part of the Dutch Government’s ‘top sector policy’ for enterprise and innovation, which focuses on nine key sectors of the economy. Based on a joint innovation agenda, TKI Maritime aims to facilitate public-private collaboration at all stages of research and ‘knowledge valorization’ (utilization) using different collaboration modalities for each stage of the knowledge and innovation chain.

A distinct feature of the Dutch top sector policy is the funding arrangement of the TKIs. Different structural public funding streams are combined with a 25% top-up by the government based on cash contributions from industry to public-private projects in the TKI programme. Based on these funding sources and using a light governance structure, TKI Maritime ensures industry is committed to playing an active role in programming, co-funding and executing research and innovation projects. At the same time TKI Maritime is able to encourage researchers to align their fundamental work with the TKI’s innovation agenda.

Reading guide

The report follows a case study template provide by the OECD Working Party on Innovation and Technology Policy Secretariat. After a summarizing table (section 1), this report describes the rationales, motives and key drivers for the ‘top sector’ approach (section 2), their governance (section 3), financing (section 4), management of intellectual property rights (IPRs) (section 5), internationalization (section 6), monitoring and evaluation (section 7), and lessons and challenges (section 8).

The Dutch top sector approach to enterprise and innovation policy was introduced in 2010. Since the set-up and working of TKI Maritime are difficult to understand without knowledge of this broader policy context, a brief overview of this policy is provided in section 2.1.

Content

1 Basic description of TKI Maritime

Table 1: Summary of TKI Maritime

Programme name	Top consortium Knowledge & Innovation (TKI) Maritime (In Dutch: *Topconsortium voor Kennis en Innovatie (TKI) Maritiem*)
Objectives	• To bundle excellent public-private collaboration in research and innovation in the maritime cluster (one of 3 TKIs in 'top sector' Water) in order to create synergy and coherence of research and innovation activities in areas with strategic relevance in terms of contribution to the Dutch economy as well as to solving societal challenges. • To enhance the efficiency and effectiveness of research and development through more strategic collaboration between businesses, knowledge institutes and the government. • To contribute to more excellent research for innovative products and processes. • To speed up the dissemination of knowledge that is produced in the public research sector to the private business sector by a stronger demand-orientated focus in research programming. • To stimulate internationally leading research and to create active connections with international themes and resources (e.g., Horizon 2020). TKI Maritime focuses on four main RD&I themes that are included in its 'Innovation Agenda' with the aim of strengthening the competitive position of the maritime industry and addressing societal challenges in transportation and offshore activities.
Programme / Project type	Public-private research and innovation programme
Responsible ministries	Leading Ministry: Ministry of Economic Affairs Relevant Ministries: Ministry of Defence; Ministry of Education, Culture and Science; Ministry of Infrastructure and the Environment
Responsible agencies	Netherlands Enterprise Agency (RVO: part of the ministry of Economic Affairs. For monitoring)
Intermediary/ Dedicated Unit	
Total duration of programme / project (years)	No fixed duration of the programme. The underlying 'Innovation Contract' is renewed every two years.
Total programme / project cost (in national currency)	The TKI does not perform research itself but coordinates a programme based on a joint innovation agenda. To fund public-private research projects, the following funding sources are used: 1. **Private funding** from industry (12.2 million euros in total in 2013)[2]; 2. **Public funding** from various sources: • Earmarked budget, i.e. research capacity) of publicly funded organisations for applied research (4.1 million euros in 2013);

[2] Note that the contributions of the private sector are not fixed. The actual private contributions (in cash) determine the TKI allowance (25% top-up) by the government. The idea is that this arrangement stimulates companies to first show their actual commitment, which is then 'rewarded' by the government with the top-up.

	• Earmarked budget of the research council NWO/STW (4.5 million euros in 2013); • 'TKI allowance', i.e. a 25% top-up[3] by the government based on private sector cash contributions to collaborative public-private research that fits within the TKI innovation agenda (4 million euros in 2013); • MIT scheme, i.e. a subsidy scheme for SME innovation in top sectors (0.85 million euros in 2013)
Technology focus/industrial sectors	Maritime technology
Legal status of the programme / project	Non-for-profit foundation (*Stichting* under Dutch private law)

[3] 40% top-up for the first 20,000 euros to stimulate the participation of SMEs.

2 Rationale, motives and key drivers

2.1 Policy context: the 'top sector approach'

Top Consortium Knowledge and Innovation (TKI) Maritime was launched as part of the Dutch Government's 'top sector' policy approach in 2011. In order to understand the set-up and functioning of this TKI, a brief sketch of the relevant policy context is useful.

The top sector policy was introduced in October 2010 by the centre-right cabinet 'Rutte I' as part of a new enterprise policy[4]. This policy was continued (and slightly adapted) by the labour-liberal cabinet 'Rutte II' from November 2012.[5] The design principles of the new enterprise policy were:

(i) fewer subsidies in exchange for lower (corporate) taxes and tax incentives;[6]
(ii) fewer and simpler rules (reduction of red tape);
(iii) broader access to corporate finance (credit facilities);
(iv) better utilization of the public knowledge infrastructure by businesses – especially in prioritized 'top sectors';
(v) better alignment of fiscal policy, education policy, foreign policy and diplomacy with the needs of businesses, especially in prioritized 'top sectors'

The policy approach is characterised by a generic and a specific track.

- The generic track aims to induce R&D expenditure and innovation by all businesses in the Dutch economy, regardless of their size, age or sector. This track is by far the largest in budgetary terms and consists of fiscal incentives: the R&D payroll tax allowance WBSO, the R&D investments tax allowance RDA, the Innovation Box which offers a special corporate income tax rate for profits from innovative activities), the SME+ Innovation Fund and several other instruments. In 2014 the total budget for the generic track amounts to 1.7 billion euros.

- The specific track concerns the 'top sector' approach. It focuses on nine prioritized 'top sectors'7: sectors which (potentially) have a strong market and export position, a good knowledge base, experience of public-private collaborations and which have the potential to contribute to innovative solutions for societal challenges. To foster further public-private cooperation in research and innovation, part of the budget for the public research infrastructure (fundamental and applied) is earmarked to some degree for the top sectors. In 2014 the earmarked budgets amount to a grand

[4] The policy was introduced in 'To the top: Towards a new enterprise policy' (Letter by minister Verhagen about the key objectives of the government's top sector approach, 04-02-2011. Available at http://www.government.nl/documents-and-publications/parliamentary-documents/2011/02/04/to-the-top-towards-a-new-enterprise-policy.html)
[5] A new element is the stronger emphasis on societal challenges.
[6] The reduction of subsidies also has to be seen in the context of the financial crisis, which led to budgetary tightness.
[7] The top sectors are Agri-food, Horticulture and propagation materials, High Tech, Energy, Logistics, Creative industry, Life sciences and health, Chemicals, and Water. The top sectors were established in the 'To the top' policy document (in Dutch). The selection of the top sectors was based on their knowledge intensity, their export orientation, and their (potential) contribution to solving societal challenges.

total of 500 million euros (total public research funding amounts to about 3 billion). In addition, the government provides a 25% top-up (the TKI allowance) to cash contributions from companies to public-private projects. TKI Maritime is part of the top sector Water. In total, 19 TKIs have been established in the nine top sectors.

The principal aim of the top sector approach to innovation and research in general - and the TKIs in particular – is to promote closer cooperation between knowledge institutes, businesses and public authorities in the programming of fundamental and applied research, with special attention to addressing societal challenges. The policy rationale is that such cooperation will increase the applicability of scientific research for both commercial and social purposes and thus increase the return on public funds devoted to research.[8] The alignment of all relevant parties in the research and innovation system is therefore a core element of this policy approach. The policy objective is that by 2015, the contribution of public and private parties to the 19 TKIs should amount to more than 500 million euros, of which at least 40% will be financed by the business sector.

The top sector policy is characterized by a 'bottom-up' approach in which stakeholders (firms, knowledge institutes, public authorities) take the lead (facilitated by the government), in designing and managing the TKIs and the renewal of the innovation contracts. This enables a tailor-made approach for each top sector; it is the stakeholders that know the specific requirements and needs of their own sectors. Ensuring that cross-sector learning occurs is a part of the facilitating role of the government.

For each top sector a 'Top Team' has been established. These Top Teams play a central coordinating role. They consist of a 'figurehead' of the specific sector and include representatives from business (including an SME representative), the public research system and the government. At the request of the government, Top Teams have developed an integral agenda for strengthening the international competitiveness of their sector. Top Teams have organized workshops and meetings with stakeholders to develop this agenda. One key part of this integral agenda is the 'Innovation Agenda', which defines joint research and innovation themes.[9] It is formalised through 'Innovation Contracts' in which firms, knowledge institutes and government commit themselves (also financially) to specific research and innovation efforts in identified fields and innovation themes. The contracts are revised every two years.

A TKI is essentially the organisational vehicle for programming and coordinating collaborative research initiatives based on these innovation contracts. TKIs do not do perform research activities themselves. Typically, the TKI programmes cover the whole 'knowledge chain', i.e. they consist of a mix of collaborative fundamental research, collaborative applied research and innovation.

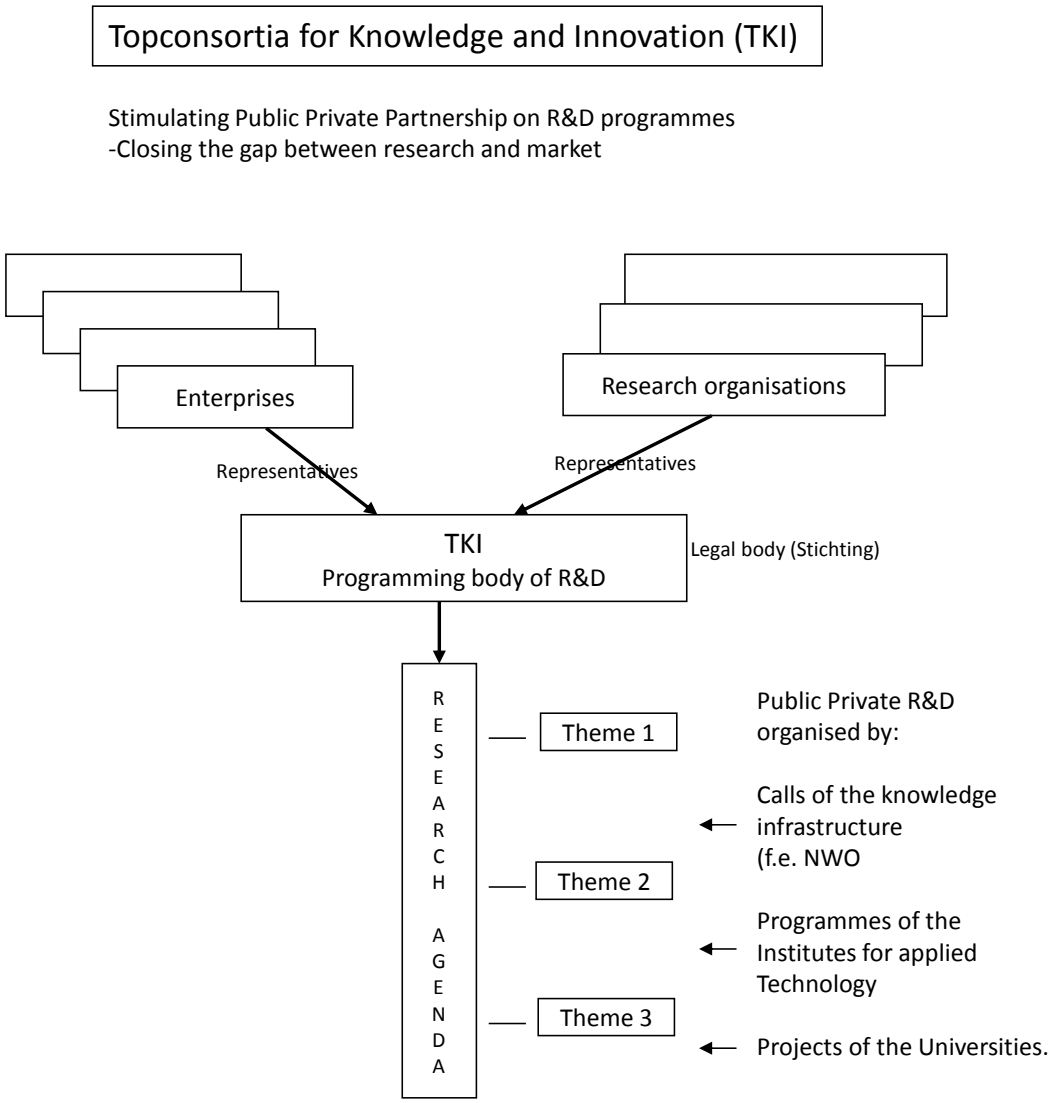
The top sector policy deliberately aims to prevent the establishment of elaborate new coordination structures or (temporary) research institutes. To this end, TKIs are intended to be 'lean and mean' and to build on existing cooperative structures and networks.

Each of the 19 TKIs has their own specific arrangements and working practices. Below the basic structure and operating mechanism of the TKIs is visualized.

[8] That effect will be enhanced by the fact that the top sector approach incorporates elements of foreign policy, education policy and additional policies to reduce the administrative burden. Another objective is to secure the active involvement of ministries and of regional and local authorities in strategy, not just financially but also by using their procurement policies to help meet the government's target of devoting 2.5% of the public procurement budget to the promotion of innovative solutions.

[9] Note that the top sector approach is broader than R&D and innovation. The integral agenda also includes an Internalisation Agenda and an Education and Training Agenda (Human Capital Agenda). The top teams were also asked to identify barriers (including regulatory ones) to innovation. In this case study, we focus on the Innovation Agenda for the Maritime cluster, coordinated by the top team Water.

Figure 1: Basic structure and operating mechanism of the TKIs



TKI – Scheme

- TKI's can apply for TKI-allowance of 25% on the private contribution in the costs of the joint programmes / projects.

- The TKI-allowance is committed to the TKI.

- The TKI uses the TKI-allowance for new Public Private R&D projects in line with the RD&I state aid rules.

2.2 TKI Maritime: the first innovation contract

In the context of the top sector policy approach, TKI Maritime developed its first innovation contract together with Top Team Water ("*Nederland: De maritieme wereldtop. Veilig, duurzaam en economisch sterk*") in 2012. It centres on four themes:

- Winning at sea;
- Clean ships;
- Smart and safe shipping;
- Effective infrastructure.

These themes require research in knowledge areas such as hydrodynamics, maritime operations, maritime constructions and materials, maritime systems and processes, maritime design and construction technology, and the impact on the marine environment.

TKI Maritime has not had to be developed from scratch, but has built on a rich history of collaboration in applied research projects and innovation trajectories, fuelled by a shared understanding that innovation based on an excellent knowledge base is key for the international competitiveness of the Dutch maritime cluster. The main initiatives and practices the TKI has been able to build on include:

- The Joint Industry Project (JIP) model, which has been used for many years by the Maritime Research Institute Netherlands (MARIN) – a central actor in the public applied research system for the maritime cluster – to facilitate and stimulate collaborative applied research. The TKI adopted this successful model for public-private collaboration in applied research.
- The Maritime Innovation Program (MIP) (2007-2011), a previous grant-based program funded by the government, in which public and private parties in the maritime sector gained experience in sector-wide collaboration. The MIP was based on a vision developed by private and private parties in the sector,[10] in which the main opportunities and bottlenecks for the maritime sector in the Netherlands were identified and elaborated in a Strategic Agenda. The innovation agenda of the TKI Maritime has been able to build on this previous agenda.

The vision of TKI Maritime is that the maritime cluster has to work together to address issues that concern all parties in the cluster. The maritime cluster consists of various connected parts: shipping (seafaring, inland shipping, navy, offshore, hydraulic engineering, fishery); the maritime industry (shipbuilding, yacht building, maritime suppliers); and service providing sectors (ports, maritime services, knowledge institutes). The Dutch maritime business sector has a strong international position, especially in short sea shipping, inland waterway vessels, dredgers, tugs, and specialized vessels for offshore activities. In order to remain internationally competitive, the innovation and renewal of processes, products and services is vitally important. This means that the whole knowledge chain, including fundamental research, applied research and 'knowledge valorization' has to be taken on board in the sector agenda for innovation.

From a business perspective, maritime firms acknowledge the need for public-private collaboration since it is a means to share the costs and risks of pre-competitive research, facilitate collaborative or open innovation strategies, and address sector-specific bottlenecks for innovation. There is a shared

[10] The private sector was represented by *Nederland Maritiem Land* (NML), and public knowledge institutes represented by the Maritime Knowledge Centre (MKC), a collaboration of four main public knowledge institutes that operate in the maritime sector.

understanding that in order to remain internationally competitive, sufficient investments in knowledge and competences are vital. The financial incentive from the government in the form of a 25% top-up on cash contributions (the so-called TKI allowance, see below) obviously helps to motivate firms to enter into public-private collaborations, but is not in itself large enough to be (and should not be) the main reason to participate. Since the top-up of the government for collaborative projects depends on the cash contributions of firms, firms have to show concrete commitments. This funding mechanism also implies that companies (want to) have a real stake and a say in the programming of the TKI.
The organizations engaged in applied research (MARIN, TNO, and others) also have a real stake in TKI Maritime, because a part of the R&D capacity that is funded by contributions from the government has to be allocated to collaborative projects within the TKI programme.

University groups are induced to participate in TKI Maritime via the involvement of the research council NWO/STW in the TKI programming. The government has earmarked a part of the research council's budgets for the top sectors. Together with the TKI, the NWO/STW develop targeted calls for proposals for (fundamental) research projects that fit within the innovation agenda of the TKI. In practice, this means that the research budget allocated *ex ante* for fundamental maritime research has risen significantly. This has increased the success rate for applicants from the maritime research area; in the past they had to compete in open programmes with applicants from many other sectors.

This enrolment of the research council NWO/STW and the applied research organizations in the (programming function of) the TKIs is one of the main policy innovations of the top sector approach. It is a key element in realizing the ambition to cover the whole spectrum from fundamental research to applied research and innovation.

3 Governance

3.1 A light governance structure

The top sector policy gives TKIs a large degree of freedom in organizing the way in which their participants collaborate and how they allocate their funding and spending. TKI Maritime has opted for a light governance structure, which largely overlaps with existing coordination structures in the sector. Firms in the maritime cluster place high value on finding practical solutions for concrete problems in actual joint projects. This emphasis on concrete joint projects partly explains the choice for a light governance structure in order to leave sufficient room for bottom-up project ideas. The innovation agenda is defined in deliberately broad terms, and the TKI itself does not intend to have a strong steering capacity. The choice for a light governance structure is also motivated by the fact that the top sector approach does not provide for a large budget to set up an elaborate governance structure and relies on underlying cooperative structures and experience amongst participants for programming and consortium building.

In practice, the initiators of TKI Maritime sought close connection with both the Top Team Water – in particular the Core Team Knowledge and Innovation Maritime – and the sector organization 'Nederland Maritiem Land' (NML) (see also section 2.2).

The TKI has two central bodies: (1) the TKI Board, and (2) the Innovation Council.

The TKI Board

The TKI Board has eight members:

- Five members of the Core Team Knowledge and Innovation Maritime of the Top Team Water (the representative of the government is not included)
- Two representatives of the Innovation Council of NML (see below)
- One representative of the research council NWO/STW.

The government is an observing member of the TKI Board, but has no voting rights.

The formal responsibilities of the TKI Board include:

- To consult with the Top Team Water and the Innovation Council of NML
- To establish the annual TKI Innovation Agenda of the maritime cluster
- To assess and approve the Research Agenda and the proposals (for calls and projects) of the TKI Knowledge Programme Council (see below)
- To collaborate with the Top Team Water, the other TKIs in the top sector Water, and other top sectors
- To submit the application for the TKI allowance
- To decide (together with the Top Team) on the allocation of the TKI allowance
- To ensure accessibility of the TKI for new and existing participants
- To ensure active involvement of SMEs
- Monitoring and evaluation
- Accountability vis-à-vis the ministry of Economic Affairs

The Innovation Council of NML

The Innovation Council serves as an advisory body and sounding board for the TKI Board. The council consists of 22 members. It includes all five members of the Top Team Water's Core Team Knowledge and Innovation Maritime (who are also members of the TKI Board, see above), complemented by RD&I managers of firms in the maritime cluster.

Membership of the Innovation Council is open to all companies in the maritime sector. Its broad composition helps to ensure a broad support base for the plans and activities of the TKI in the maritime cluster. The involvement of RD&I managers (rather than CEOs) is seen by TKI Maritime as one of the strengths of the Innovation Council. Because of their position, these people combine a strategic overview of their companies with an ability to translate discussions into practical projects. In this way, members of the Innovation Council are quickly able to recognize collaboration opportunities between partners.

Other parts of the TKI organization

The TKI organization further consists of a TKI Bureau, Knowledge Program Council, and a coordinator from the research council NWO/STW:

- The TKI Bureau is responsible for administration and operational management. The TKI Bureau is part of the NML Bureau in order to reduce overhead costs.
- The TKI Knowledge Programme Council is responsible for drawing up and presenting the Research Agenda. It has the same members as the Management Team of the Maritime Knowledge Centre (MKC)[11], supplemented by representatives of the research council NWO/STW, SMEs and other public knowledge institutes in the maritime sector.
- The NWO/STW coordinator is responsible for the management of the NWO/STW calls according to NWO/STW procedures.

TKI Maritime as part of the top sector Water

The Top Team Water is responsible for assuring the connection between the TKI Maritime innovation contract and the broader agenda of the Water sector. The chair ('figurehead') of the Top Team Water has the final responsibility for the development and execution of the innovation contract of the top sector, the monitoring of progress, dealing with bottlenecks as they occur and stimulating coherent action of the sector as a whole.

Responsibilities are delegated to various Core Teams that focus on specific clusters (e.g. Core Team Knowledge and Innovation Maritime) or themes (e.g. export and trade promotion, human capital, export financing, ICT). In order to ensure flexibility and responsiveness, the organisation and the division of roles and tasks can be adapted to changing circumstance. Therefore, the composition and mandates of the Core Teams are temporary. The existence of Core Teams is not a requirement of top sector policy but a choice of the top sector Water.

[11] The Maritime Knowledge Centre (*Maritiem Kennis Centrum*, MKC in Dutch) is a public-private collaboration with the mission to strengthen synergy between knowledge institutes in order to further develop the Dutch maritime knowledge base. Partners include:

- Public knowledge institutes in the maritime sector (the applied research organization TNO, the Technological University Delft, the Maritime Research Institute Netherlands (MARIN) and the Royal Netherlands Naval College (part of the Netherlands Defence Academy));
- Large maritime firms (Damen, IHC-Merwede, Imtech, Wärtsilä, Allseas and Heerema Marine Contractors)
- Small and medium-sized maritime firms – via the sector organizations.

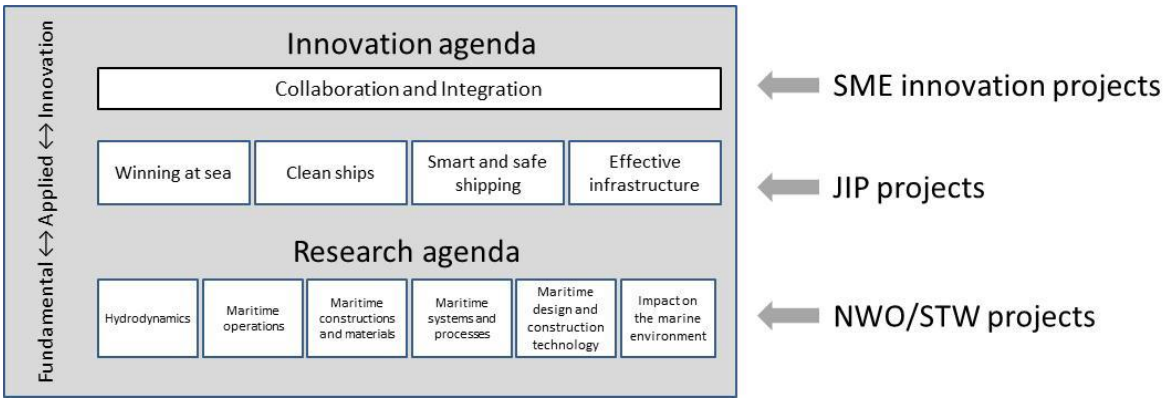
Other collaborators include the Defense Material Organization (DMO), the Royal Netherlands Institute for Sea Research (NIOZ), and the Institute for Marine Resources and Ecosystem Studies (IMARES).
MKC also functions as Knowledge Advisory Council for the TU Delft and TNO in the area of marine and offshore.

3.2 Collaboration modalities

The ambition of TKI Maritime is to cover the whole knowledge and innovation chain. For each stage in this chain, TKI Maritime has a specific collaboration modality:

- Fundamental research questions are addressed by targeted calls for proposals by the research council NWO/STW for research projects that fit within the innovation agenda of the TKI. In general, the larger the private co-funding requirement, the larger the involvement of the TKIs in the content of the calls. Knowledge institutes may respond to the calls.
- Applied research activities are organized in so-called Joint Industry Projects (JIPs). These research projects involving a group of maritime companies are organized to jointly solve a problem or to jointly develop a new technology. JIPs are developed 'bottom-up'. To facilitate project development, TKI Maritime organizes matchmaking events where ideas for projects can be presented and consortium partners found. The applied research institutes (in particular MARIN and TNO) and the Delft University of Technology (TU Delft) play a major role in the JIPs as performers of research.
- 'Knowledge valorization' is stimulated by the SME support scheme (MIT scheme). The scheme subsidises the funding of SME feasibility studies and innovation. TKI Maritime organizes SME events to provide information and networking opportunities. In addition, an SME 'front office' is mandatory for each TKI and is available for SMEs in the maritime sector.

Figure 2: Research and innovation themes in the programming structure of the TKI



By bringing together these different collaboration modalities, TKI Maritime aims to create a knowledge network or ecosystem that stimulates new research questions and knowledge production across the full innovation chain. This does not necessarily happen in a linear way from fundamental research to applied research through to valorization. A typical way in which the connections and alignments between fundamental and applied research might be realized in practice is as follows: a JIP may lead to new research questions, which may inspire parties to develop research themes and proposals for NWO/STW calls for fundamental research. The requirements for private co-funding on the NWO/STW call induce knowledge institutes to seek connections with JIP initiatives in order to get (paying) industrial partners on board. In turn, insights from fundamental research projects may lead to follow up JIPs. This occurs without much active interference of TKI Maritime itself. The interlinking of the various components in the knowledge chain relies on self-organization by the public and private parties in the maritime cluster and the matchmaking activities of the dedicated STW program officers before and during the research

projects, with the agenda setting and TKI programming as a common framework and stimulus to set up new collaborative projects.

Joint Industry Projects (JIPs) play an essential role in TKI Maritime and the majority of activities within the TKI are organized via JIPs. The JIP model was introduced (long before the top sector policy) by the Maritime Research Institute Netherlands (MARIN) to organize joint research for and by a group of 5 to 25 maritime companies in order to solve a shared problem or to develop a new technology. New JIP initiatives emerged bottom-up through interactions in ongoing projects and networks. To assess what results might be achieved, knowledge institutes (e.g. MARIN) perform initial background research, financed by their public funding resources. Based on these results, JIP initiatives can be developed. Because JIPs are jointly funded by a group of companies, the group has to be open to all interested firms. The financial entry barriers are therefore low, but the results could be substantial. Moreover, the interactive mode in which the research is performed allows for steering towards applicable results.

3.3 Programming and portfolio management

The program of TKI Maritime covers four main themes that are readily recognized by all actors in the sector (see also figure 1):

- Winning at sea (mining of raw materials and production of energy)
- Clean ships (fuels, fuel efficiency, emissions, sub-aquatic noise)
- Smart and safe shipping (special ships, smart systems, defense, safety)
- Effective infrastructure (interaction between ship and infrastructures of ports and waterways)

These - deliberately broad - themes were defined in order to leave ample room for bottom-up initiatives that address actual knowledge needs of maritime companies. In principle, TKI Maritime facilitates any collaborative research project that fits within the themes in the innovation contract and meets certain formal requirements, e.g. level of private co-funding.

The innovation contract has to be updated every two years. This allows for flexibility in the allocation of public research budgets and in addressing new viable economic and societal themes. In terms of portfolio management, this creates an opportunity to take stock of all projects under the TKI umbrella in order to assess where additional efforts and/or program adjustments would be desirable. The TKI translates this contract into a set of concrete research calls and research projects on a yearly basis.

The role of the TKI is to signal ‘blind spots’ and to facilitate parties to come together around such topics. TKI Maritime has no budgetary means to stimulate new directions and projects to which industry has not yet contributed. TKI Maritime has chosen to feed back the TKI allowance directly to the companies that have brought in cash contributions in order for them to use it in follow-up research. (Other TKIs chose to reserve part of the TKI allowance for active portfolio management.)

3.4 Participation

The TKI is open to all companies for the development of joint projects that fit within the innovation agenda. ‘Membership’ (and membership fees…) is not required. At the programming level, the TKI has tried to involve all relevant parties, e.g. via the Innovation Council of NML and the TKI Knowledge Program Council (see above for their broad composition).

The top sector policy pays particular attention to the active involvement of SMEs.

- The first 20,000 euros of private cash contributions are rewarded with a higher TKI allowance (40%) to promote the participation of SMEs in joint projects. As of 2014, the first 20,000 euros of private contribution may be in kind.
- The government has also introduced the MIT scheme for SMEs, which can be used in all top sectors. For many SMEs the cash contribution for JIPs is an obstacle for participation, and the top-up by the government does not provide enough incentives for these companies. The MIT scheme has helped the TKI Maritime to reach SMEs.
- Another means to stimulate SME involvement is the requirement by the top sector policy that TKIs have to set up an 'SME front office' (*MKB Loket* in Dutch). The objective of the SME front office is: (1) to have a direct contact point for SMEs for questions on the top sector approach and the maritime innovation agenda, and (2) to organize events for SMEs and increase their involvement.

Foreign companies are allowed to participate in the TKIs and the government also provides the 25% allowance on their cash contributions.

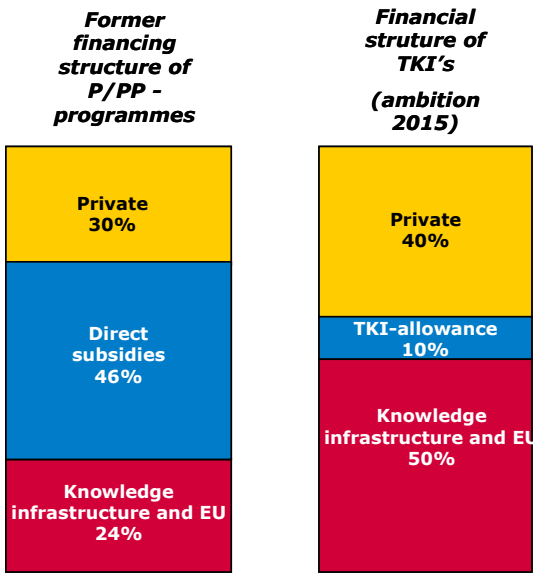
Although participation in the TKI is open, JIPs can be closed to new entrants at the project level, under certain conditions, for example in order to allow companies to bring proprietary knowledge into a project. All IPR conditions for public-private research are in accordance with EU rules for State Aid and research institutes must be able to publish at least parts of the results.

4 Finance

The top sector policy requires that a TKI program should have an annual budget of at least five million euros to assure critical mass. Companies and knowledge institutes have to collaborate on a shared cost and shared risk basis (i.e. contract research is not covered by the TKI). The government gives a TKI allowance (a 25% top-up) on the cash contributions of companies collaborating with publicly funded research organisations. The projects or annual contributions to the projects have to be new, i.e. they cannot have received any previous subsidy. Contributions from foreign companies can also be taken into account. The quantitative contribution of private parties within the TKI (cash and in kind) has to amount to at least 40% by 2015.

This policy marks a major change when compared to the financial structure of previous public-private collaboration. The figure below illustrates this, showing the higher contributions from parties in business sectors and knowledge institutes.

Figure 3: Financial structure in previous and current situation



The governmental funding for projects in the TKI comes from four sources:

1. An earmarked part of the budgets for applied research institutes for top sectors, in this case for projects that fit within the innovation contract of the maritime sector;
2. An earmarked part of the budget for the research council NWO/STW for top sectors, in this case for research projects that fit within the innovation contract of the maritime sector;
3. The TKI allowance from the government as a percentage of the cash contribution of companies to public-private projects;
4. The SME innovation support scheme top sectors (MIT scheme).

The streams coincide with the various phases of the knowledge chain. The table below summarizes the size of these streams in 2013.

Table 2: Funding streams TKI Maritime in 2013

Funding stream	**Size** (in million euros)
Earmarked budgets of applied research institutes	4.1*
Earmarked budget of research council (NWO/STW)	4.50**
TKI allowance Joint Industry Projects (JIPs)	3.70
TKI allowance for fundamental research with NWO/STW	0.28**
MIT scheme	0.85

* MARIN 3.6; TNO 0.5.
** For four-year projects; additionally the public research institute for research at sea earmarked 1.9 million euros in kind contribution for maritime research.

The total private contributions to the TKI program amounted to 12.2 million euros in 2013.

Earmarked budget of the applied research institutes

A part of the annual publicly-funded budget for applied research organizations is earmarked for the top sectors. In 2015 these applied research organizations are expected to contribute 250 million euros in research capacity to the top sectors of which 100 million euros are jointly financed. Every year the top sectors have to advise on the intended research plans of the applied research institutes. These plans are part of the TKI innovation agenda.

Earmarked applied research organization budgets are allocated among sectors on the basis of expertise, impact and private contributions. Some applied research institutes, such as MARIN, have a specific expertise that is predominantly devoted to one sector. However, in order to meet economic and societal priorities and address cross-sector themes, institutes for applied research have some discretion in distributing their total research efforts over themes and sectors within the annual renewal of their research program and within the two yearly renewals of the innovation contracts.

Within their annual research programs, applied research organizations have to indicate how the earmarked part of their budget is used for the innovation contracts of the top sectors. The Top Teams advise the government on the annual research program in the subsidy decision.

In the case of TKI Maritime, the two most relevant research institutes are the Maritime Research Institute Netherlands (MARIN) and the Netherlands Organization for Applied Scientific Research (TNO). Their earmarked budget allocations amount to 3.6 million euros, and 0.5 million euros, respectively.
For applied research, TKI Maritime uses the JIP model to organize its public-private projects.

Earmarked budget of the research council

Another funding stream comes from the research council NWO/STW[12]. The top sector policy anticipates that a significant part of its annual budget is allocated to research in the top sectors. In 2015 a total of 275 million euros will be available for programmatic research for the top sectors, of which 100-125 million euros will be jointly financed.

The research council remains responsible for the actual distribution of the earmarked budget across the TKIs.

[12]The Technology Foundation STW is part of the research council NWO and acts as the NWO Division for Technical Science. It also receives funding from the Ministry of Economic Affairs in order to stimulate application-oriented multidisciplinary research.

It will be divided over the various top sectors on the basis of demand and capacity within the several disciplinary divisions of the research council NWO/STW, the societal impact, research excellence, and private commitments. To allow for some flexibility and adjustment to economic priorities, part of the total budget for NWO/STW can be divided over sectors following the degree of private commitments over the two yearly renewal period of the innovation contracts.

4.5 million euros of the NWO/STW budget is earmarked exclusively for research projects that fit within the Innovation Agenda of the TKI Maritime. The budget is used for two types of projects: technological-scientific projects (3 million euros) and multidisciplinary projects with a link to impact on the marine environment (1.5 million euros). Private co-funding is required, both in kind and in cash, in order to stimulate public-private collaboration. The sector has agreed with NWO/STW that the private contributions amount to 25% in cash and the TKI allowance will be based on this assessment.

In collaboration with the top sector Water and TKI Maritime, the research council NWO/STW organised a 'Maritiem-2013' call.[13] From 2014 onwards, this call will compete with calls from the two other TKIs within the top sector Water to give an incentive for excellence. In addition, part of the budget for the top sector Water is intended for a joint call on themes that require joint expertise of different TKIs within the top sector Water, like the integral Delta challenges.

TKI allowance

A key characteristic of the top sector approach is that the subsidy budget is not allocated up-front to sectors and participants, but rather that it is the commitment of participants themselves that determine the support from the government. Essentially the TKI allowance is a 25% top-up on the cash contribution of companies to research organisations in collaborative projects within the TKI. The allowance for the first 20,000 euros contribution is 40% for each company. This first 20,000 euros may be in kind. This is meant to make collaboration more attractive for SMEs (see also section 4.2).

Based on private contributions of 12.2 million euros in 2013, TKI Maritime applied for a TKI allowance of 3.7 million euros for 49 JIPs and the anticipated NWO/STW call. TKI Maritime has decided to transfer this allowance back to the project participants in accordance with their cash contribution to be used for new (follow-up) collaborative research projects. TKI Maritime takes only a small percentage of the TKI allowance for overhead costs. Other TKIs have used the allowance for governance or portfolio management activities or for organizing calls on specific themes.

SME innovation support scheme top sectors (MIT scheme)

The top sector policy introduced the SME innovation support scheme (MIT scheme)[14] to stimulate SME participation in areas such as funding for feasibility studies, knowledge vouchers, hiring knowledge workers, public-private collaboration in research and development, and Innovation Performance Contracts (IPCs). The Top Teams of the top sectors can determine which instruments are available for their sector. In the top sector Water, TKI Maritime opened three instruments under the MIT scheme: (1) feasibility studies, (2) knowledge innovation vouchers, and (3) network activities.

[13] The Call is a joint initiative of two NWO divisions: Technology Foundation STW and Earth and Life Sciences.
[14] MKB-Innovatiestimulering Topsectoren – MIT in Dutch.

Table 3: Instruments of the MIT scheme

	Feasibility studies	**Knowledge vouchers**	**Network activities**
Description	This instrument enables SMEs to conduct a feasibility study. Feasibility studies consist of desk research (literature research, patents analysis, marketing research, etc.), possibly supplemented with some 'quick & dirty' experiments	This instrument provides SMEs with 'vouchers' to involve research institutes for a specific knowledge demand.	This instrument allows the TKI to organize network events for maritime SMEs (master classes, workshops, conferences, etc.).
Available budget (2013)	500,000 euros	150,000 euros	50,000 euros
Requirements	• 50% subsidy for studies with a max of 5,000 euros • Min. 1 participating SME First-come-first-served	• Max. value per voucher 7,000 euros (50% paid by SME) Available for c. 30 SMEs	• Only the TKI can apply for this instrument Programme composed by the Innovation Council of NML

For research in collaboration and for part of the activities of the MIT scheme, private contributions have to be made in accordance with EU State Aid provisions.[15]

In the top sectors about 70% of all 1,900 firms involved are SMEs.

[15] The TKI allowance arrangement demands somewhat higher private contributions than established in the State Aid framework so as to maximize private involvement with collaborative research.

5 The management of IPRs

TKI Maritime follows the general ‘rules of play’ regarding IPRs which are applicable to all TKIs (see appendix C). These rules have been developed specifically for guiding public-private collaboration in the top sectors. A guiding principle is that participants should be able to benefit from their participation in a public-private collaboration. In practice, rules were developed for background knowledge (pre-existing knowledge of participants) and foreground knowledge (knowledge developed during the project). The latter is further categorized into freely available knowledge, internal know-how (available for all project participants) and intellectual property rights (for which special rules apply). Basic rules concern property rights, access and use of knowledge during and after a project, further use by the research organization for project participants and third parties, and access by third parties. It is possible to keep certain knowledge secret in order to create internal know-how (trade secrets) or to be able to apply for a patent. In case a participant wants to publish results, the publication has to be screened first (within one month) by participating companies and the research organization.

With regard to the cost, the intellectual property owner should bear the cost in principle, while users or stakeholders that are not co-inventors, make a reasonable contribution. When a research organization transfers or sells its IPRs to a company, the cost should be in line with market prices. The project contributions of the company can be deducted from the price. What constitutes a price in line with the market can be based on three models: (i) cost-based, (ii) market-based (similar IP transactions) and (iii) income-based (future revenues). Appendix C provides a detailed table defining the IPR rules of the top sector approach.

The ‘rules of play’ have helped to streamline various IPR arrangements that have been used by various research funding organizations and by public-private consortia. For instance, STW has now adapted its IPR rules to fit with these rules of play.

TKIs can make tailor-made IPR arrangements based on these standard rules of play. The TKI Board remains responsible for the management of IPRs arising from the results of research carried out under the TKI umbrella. In case of TKI Maritime, IPRs were not a significant issue. In this sector, patenting is not a widely used way of protecting knowledge (unlike in the high-tech sector). MARIN, for example, does not chose to patent findings from their research, but allows everyone (on the basis of the rules of play for IPR) to take innovations to a higher technology readiness level (TRL). This position is motivated by a non-linear view on innovation; patenting at MARIN ‘s level might prevent further diffusion of knowledge, especially for SMEs.

6 Internationalization

Internationalization in the top sector policy

Promotion of international trade and international collaboration in R&D are integral elements of the top sector policy. The focus is on enhancing Dutch economic diplomacy, creating an international level playing field and promoting 'Brand Holland' abroad. The Ministry of Economic Affairs has set up an Innovation Attaché Network (IA-Network) in many countries to support the international RD&I ambitions of private firms and research organizations in the top sectors. The Innovation Attachés are based in Dutch Embassies and Consulates. They provide liaison for international R&D collaboration, are trend watchers and scouts alert to opportunities for technological R&D and future markets and act as a helpdesk, dealing with questions from the Dutch R&D community. They may also assist in the strategic acquisition of foreign R&D investments.

In addition, the government and top sectors collaborate in setting a joint agenda for trade missions.

Internationalization strategy of the top sector Water and the maritime sector

The top sector policy demands that all Top Teams develop an internationalization strategy. The internationalization strategy of the top sector Water is based on the notion that Dutch expertise in the areas of maritime, delta technology and water technology can make significant contributions to providing solutions for global challenges. The internationalization strategy of the maritime cluster is focused on creating structural relations with other strong maritime regions, on international branding and on promoting a favourable international trade climate (including an international level playing field).[16]

The Foundation *Nederland Maritiem Land* (NML) plays a central role in the maritime cluster with regard to internationalization. In particular, NML has set up a Trade Council which includes maritime experts on international entrepreneurship and which organizes joint export activities. The aim of the Trade Council is to promote equal conditions for international competition in the maritime cluster and enable joint marketing and maritime branding. It also has a role in identifying bottlenecks in international law and regulations.

Openness of TKIs for foreign partners

Foreign companies can participate in the TKIs, and their cash contributions also count as a basis for the TKI allowance.

The funding of the TKI program via the earmarking of a part of the budget of applied research institutes introduces a national bias with regard to knowledge institutes. Foreign research organizations are

[16] With regard to internationalization, the following issues were brought forward by the maritime sector:
1. Ensuring a level playing field by removing trade barriers, counteracting on state aid, ensuring a competitive fiscal climate, and adequate foreign policy measures.
2. Deploying foreign policy for promoting international export and international sourcing of talent, e.g. by strengthening economic diplomacy, by promoting market access of ship-owners, and by active involvement in trade promotion and acquisition.
3. Creating (stronger) relations with global maritime hot spots.
4. Attracting foreign investors.
5. Positioning of the Netherlands as central node global networks, with excellent knowledge and innovation, supported by good education and training.
6. Ensuring good export credit facilities.
7. Focused collaboration with other countries.

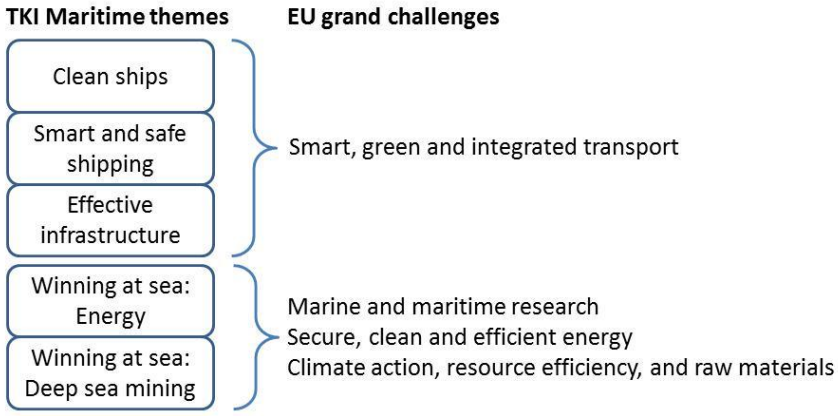
allowed to participate but the TKI allowance scheme requires that the allowance primarily contributes to the Dutch public knowledge infrastructure so as to reward their commitment to mission-driven research.

Connection with Horizon 2020

The top sector policy aims to strengthen the link between the top sectors and the societal challenges identified by Horizon 2020. One reason is that these challenges represent the future growth markets for the top sectors. In addition, aligning the top sectors with European themes will allow them to cooperate better internationally and participate with success in Horizon 2020 and other European initiatives. To stimulate such alignment, part of the budget of the research council NWO/STW is used for co-funding of participation of universities and research institutes in EU projects with relevance for top sectors.

The Dutch Maritime cluster has actively participated in EU projects, in particular the Transport call of FP7 (Sustainable Surface Transport, SST), and it is well connected to European collaboration networks. It contributes to programming within Horizon 2020 and themes in the Innovation Agenda of TKI Maritime overlap to a large extent with grand challenges. For instance, the themes 'Clean ships', 'Smart and safe shipping' and 'Effective infrastructure' fit within the grand challenge 'Smart, green and integrated transport'. The theme 'Winning at sea' has links with the grand challenges 'Food security, sustainable agriculture, marine and maritime research and the bio-economy', and 'Secure, clean and efficient energy' and 'Climate action, resource efficiency, and raw materials'.

Figure 4: TKI Maritime innovation themes and European grand challenges



The alignment with innovation themes at the European level is also visible in the alignment of the innovation agenda of TKI Maritime with the strategic research agenda of the European Technology Platform WATERBORNE, a forum for stakeholders from the waterborne sector (sea & inland).[17]

[17] Important topics in the SRA are:
- Sustainable transport: green, secure and competitive transport with intelligent use of the infrastructure.
- Exploitation of sea resources: winning of energy, materials and fuels at sea
- Understanding the oceans: reducing side effects, for instance emissions and underwater noise.

The first topic links with the TKI Maritime themes 'Clean ships', 'Smart and safe shipping' and 'Effective infrastructure'. The second topic overlaps with 'Winning at sea'. The third topic is part of the theme 'Clean ships'.

7 Monitoring and evaluation

The top sector policy determines the way TKIs are monitored and evaluated. Information collected is used by the government to show that resources have been spent well, what they have been used for, and the results. The TKIs themselves are obliged to provide management information but an important policy principle is that the administrative burden for the TKIs and their stakeholders is kept at a minimum.

The monitoring information that has to be gathered annually forms the basis for the annual progress report of the Ministry of Economic Affairs to Parliament. The TKIs have to deliver the required information (before the 1st of July) to the Netherlands Enterprise Agency (RVO), which is responsible for the data management of the enterprise and innovation policy.

The information that TKIs have to make available annually to RVO is categorized in four parts.

Table 4: Information TKIs must supply

Category	**Indicators**
Sources and uses of funds	1. Received funding in the past year by source (public, private, etc.) and type (cash, in-kind, revenue from IP).
	2. Allocation of resources by destination (research, utilization of research results, overhead costs, other).
	3. Allocation of research funding by theme (i.e. themes or programme lines as identified in the research roadmap or agenda).
Scope	4. Number of participating parties to research projects (+ address etc.).
	5. Proportion of SMEs, large firms, knowledge institutes and others as share of total participating parties.
	6. Proportion of young firms (< 8 years) as share of total participating parties.
Actions	7. Number of research projects (split into on-going, started and finished in past year).
	8. Number of projects aimed at utilisation of research results (split into on-going, started and finished in past year).
Results	9. Scientific publications (based on research funded by the TKI).
	10. Number of innovations: successfully finished innovation projects (patent applications, spin-offs, new products / services / processes).

It is compulsory for the TKI to submit an annual report (before 30th of May) to RVO. The annual report consists of a quantitative and a qualitative part. For both parts, standard formats are used. The annual report serves multiple objectives. It gives the Ministry of Economic Affairs information about the results of the TKIs. The public information element on the TKI projects also informs the general public (via www.volginnovatie.nl). In addition, the information serves as justification for the use of the TKI allowance, both for RVO and the European Commission. Finally, the information is used in mutual learning activities across and between the 19 TKIs on how to set-up and manage public-private collaboration effectively.

The annual reports of all TKIs are also to be reviewed by the Advisory Council for Science and Technology Policy (AWT)[18]. This review will serve as a formative evaluation that should provide lessons and stimulate the exchange of good practices for public/private partnerships among the different TKIs.

The law requires that the TKIs should be evaluated every four years. The Ministry of Economic Affairs is responsible for the TKI evaluation and contracts an independent organization to carry this out. The evaluation report is also to be used as management information for the TKIs themselves. The policy instrument of the TKI allowance will be evaluated in 2015.

[18] The Advisory Council for Science and Technology Policy (AWT) advises the Dutch government and parliament on policy in the areas of scientific research, technological development and innovation.

8 Lessons and challenges ahead

In this section we highlight interesting lessons and challenges for policy making that can be drawn from the case study of TKI Maritime.

Governance

1. The top sector policy gives stakeholders (companies and knowledge institutes) a prominent role in designing, programming and managing the TKIs. The government aims to induce private and public parties in sectoral innovation systems to jointly develop and execute a portfolio of collaborative projects based on a broadly shared innovation agenda by:

    a. Providing generic rules and guidelines that leave room for tailor-made arrangements;
    b. Earmarking a part of the public funding for research (funding) organizations to program research that fits within the joint innovation agenda;
    c. Providing a TKI allowance (a 25% top-up) on *cash* contributions of companies to public-private projects;
    d. Demanding that innovation agendas are renewed every two years to allow for renewal and addressing upcoming viable economic and societal themes.

    In the case of the TKI Maritime, this has helped:
    - To ensure real commitment from private parties in public-private research and innovation projects;
    - To promote demand (and societal) oriented research programming across the whole spectrum of research and innovation;
    - To stimulate the active involvement of established organizations in the Dutch research system, in particular the research council and institutes for applied research, in the programming and execution of research and innovation.

2. TKI Maritime functions as a governance arrangement for the programming of projects that cover the whole chain of fundamental research, applied research and innovation, based on a joint innovation agenda. Before the introduction of the top sector policy, the Dutch government stimulated public-private research collaboration through various incidental programmatic subsidies that were often channeled through ad hoc governance arrangements. This resulted in a complicated governance landscape. The TKIs have reduced this complexity by bringing initiatives in public-private collaboration in top sectors under one shared agenda for research and innovation.

    Crucial elements that facilitate this approach include:

    - The structural involvement of the research council NWO/STW, ensuring alignment of fundamental research programming with the TKI innovation agenda;

- The structural involvement of the organizations for applied research, ensuring alignment of their research programs with the TKI innovation agenda.

3. The top sector approach relies on the involvement of structural governance arrangements and funding channels in the Dutch research system. This allows that the governance structure of the TKI Maritime can be kept rather light. The funding approach induces stakeholders to develop a 'lean and mean' organizational set-up of the TKIs. TKI Maritime was able to build on existing structures and arrangements for collaboration and interaction, which gave it a head start. In practice, the governance structure of TKI Maritime largely overlaps with the governance structure of the maritime sector organization NML. In new and emerging sectors or in sectors without a tradition of public-private partnerships, more efforts will be needed to create an effective governance structure.[19]

4. The case of the TKI Maritime shows that a sector approach can be effective in facilitating challenge-oriented research and innovation collaborations across the whole knowledge chain. Societal challenges, however, often go beyond sector boundaries, creating a challenge for policy to induce public-private collaborations across and between sectors and their TKIs. Additional policy efforts may be required to ensure that a sector-based governance structure does not become a barrier for cross-sector challenge-oriented research. In the top sector policy this is acknowledged and additional measures are currently being developed to further facilitate cross-sector collaboration, e.g. with regard to the TKI allowance when multiple TKIs are involved, and in the MIT scheme. A related challenge for policy is to involve all relevant governmental departments in such programming for societal challenges.

5. TKI Maritime has opted for an innovation agenda with broad themes, leaving ample room for bottom-up initiatives without proactive steering by the TKI. Typically, TKI Maritime does not organize its own calls, but relies on companies and knowledge institutes to develop joint projects. The emphasis on bottom-up initiatives fits the maritime sector, which traditionally has put emphasis on R&D with high technology readiness levels. Several other TKIs (e.g. TKI Agri&Food) work with more detailed themes or roadmaps that require a more pro-active portfolio management approach – sometimes with calls for proposals organized by the TKI itself. It seems desirable to leave room for TKIs to determine themselves how much effort they deem appropriate for managing the project portfolio and making sure there are sufficient synergies and coherence among the different projects.

Finance

6. The TKIs are funded by an innovative combination of public and private funding sources. The TKI allowance based on cash contributions from industry provides an incentive for industrial commitment. The structural earmarking of a certain part of the budgets of research council NWO/STW and of the applied research institutes ensures demand-orientation for public research expenditures. Thanks to this funding arrangement and co-funding requirements, industry has a prominent role in the programming and implementation of the joint innovation agenda.

[19] Most of the Dutch top sector can build on experience with a previous policy instrument for public-private partnerships, such as Leading Technological Institutes (TTIs).

7. TKI Maritime has chosen to transfer most of the TKI allowance directly back to the actors that provided the funding basis for it. This is in line with the emphasis on bottom-up dynamics in implementing the innovation agenda, with the TKI in a facilitating role with responsibilities such as matchmaking and offering a front office for external parties.[20] For now, this light form of portfolio management is considered adequate by the consortium because there is no shortage of good initiatives for joint projects. However, there is a risk that this approach will induce a focus on incremental rather than radical innovations. In order to ensure that riskier, longer-term projects are also developed by a strategic public-partnership like TKI Maritime, a budget may be needed to initiate projects for which companies are hesitant to pay cash contributions.

Management of IPRs

8. The development of general 'rules of play' for IPR has helped to streamline IPR arrangements within and between top sectors. Thanks to a joint effort at the collective level, individual TKIs are able to save time and energy on negotiations on this issue. The breadth of the working group that was responsible for formulating the rules, including representatives of most relevant organizations, has contributed to the legitimacy and support of the resulting rules. TKIs in principle follow the rules, but still have the possibility of renegotiating if there is a need for tailor-made solutions. (see Appendix C for more details on IPR management.)

Internationalization

9. Foreign companies may participate in the TKI and their cash contribution counts as a basis for the TKI allowance. Foreign research organizations are also allowed to participate, but the scheme requires that the allowance is primarily contributed to the Dutch public knowledge infrastructure so as to reward their commitment for mission driven research.

10. The top sector policy aims to strengthen the link between the top sectors and the societal challenges identified by Horizon 2020. Not only because these challenges represent the future growth markets for the top sectors, but also to stimulate international cooperation and participation in Horizon 2020 and other European initiatives. The innovation agenda of the TKI needs to address societal challenges. The government has not played an active role in the agenda-setting process, but has relied on the consortium partners to articulate the challenges and to program research needed to tackle them. A part of the budget of the research council NWO/STW is used for co-funding of participation of universities and research institutes in EU projects with relevance for top sectors.

11. Promotion of international trade and international collaboration in R&D are an integral part of the top sector policy. In particular the Innovation Attaché Network is used to strengthen economic diplomacy and its alignment with the top sectors. The top sectors also collaborate with the government in setting a joint agenda for trade missions.

[20] Some other TKIs have chosen use the TKI allowance also for more active portfolio management.

Monitoring and evaluation

12. TKIs need to deliver an annual report designed to serve multiple objectives and audiences (e.g. the Ministry and the general public). Information in the annual report is also used in mutual learning activities across and between the 19 TKIs on how to set-up and manage public-private collaboration effectively.

Appendix A

This case study is a collaborative effort of the Rathenau Instituut and the Dutch ministry of Economic Affairs.

Data for the case study was collected via semi-structured interviews and document analysis. The interviews covered the topics described in sections 2 to section 8. To enrich our perspective on the case of TKI Maritime, we also interviewed the director of a second TKI. We carried out 3 interviews lasting between 1 and 1.5 hours. In two interviews we spoke with two interviewees at the same time (see also the overview of interviewees):

Overview of interviewees	
Bas Buchner Marnix Krikke	Director TKI Maritime Secretary TKI Maritime
Eppo Bruins Ruben Sharpe	Director Technology Foundation STW Program Officer Technology Foundation STW
Kees de Gooijer	Director TKI Agri&Food

In addition, we analyzed relevant documents, including:

- Ministerie van Economische Zaken, Landbouw en Innovatie (2012). IPR kader voor TKI's: Een handreiking.
- Ministerie van Economische Zaken (2013) Progress Report on Enterprise Policy: Enterprise Policy at Full Speed
- Technology Foundation STW (2013). Call TKI Maritiem: Call for Proposals 2013 voor projecten in het TKI Maritiem.
- TKI Maritiem / Nederland Maritiem Land (2013). Nederland: de Maritieme Wereldtop. Veilig, duurzaam en welvarend. Update Innovatiecontract en Jaarplan 2014.
- TKI Maritiem / Nederland Maritiem Land (2014). Mkb Innovatie Event (presentaties bijeenkomst 12/03/2014).
- Werkgroep Innovatiecontract Chemie (2011). Topsector Chemie: Innovatiecontract 2012 – 2016.

Relevant websites

- General website on top sector policy: http://topsectoren.nl/
- Website of RVO on TKIs in general: http://www.rvo.nl/subsidies-regelingen/topconsortia-voor-kennis-en-innovatie
- Website of the TKI Maritime: http://www.maritiemland.nl/NL/1825/tki-maritiem.html

Appendix B

TKI allowance and the financial 'rules of play'

The TKI allowance in more detail[21]

The size of the TKI allowance depends on the total private contribution to research organizations (universities, applied research institutes, etc) in public-private collaborative projects and research contracts that are relevant for the TKI. The TKI allowance is 25% of that private contribution. For the first 20,000 euros (per participant) the percentage is raised to 40%. This sum of 20,000 euros may be *in kind*, but the rest of the contribution must be *in cash* in order to be taken into account for the calculation of the total TKI allowance. The TKI uses the allowance it receives from the ministry of Economic Affairs for collaborative projects, network and matchmaking activities. The TKI has the option to use the TKI allowance to raise the budget of the MIT scheme, which specifically targets innovation by SMEs in the top sectors.

There are two types of TKI allowance

- Program-based allowance, which is calculated on the basis of the private contribution for a set of projects within one year. A TKI may use the program-based allowance for multi-year commitments.
- Project-based allowance for individual projects, which is calculated on the basis of the private contribution during the whole duration of the project.

Following experiences gained in 2013, the rules for the TKI allowance were simplified and broadened in 2014, in order to do more justice to differences between sectors

- A first change was that *in kind* contributions of companies to public-private research are also taken into account in the calculation for the TKI allowance. This concerns the first 20,000 euros per participating company. This change enabled more SMEs to participate in the TKI program in several top sectors.
- A second change was that private contributions from charitable organizations (in Dutch: *instellingen van algemeen nut*) could be taken into account. This concerns contributions with a maximum of 8 million euros for each top sector as a base for the calculation of the TKI allowance.
- A third change was that contract research that is relevant for the TKI program could be taken into account. Within several top sectors, privately funded contract research does contribute significantly to the TKI research agenda. The condition is that results from such contract research are actually applied within the TKI program. In addition, multiple parties must be able to utilize the results – not just the contract parties themselves

Application process for a TKI allowance

Only TKIs that are listed in the budget of the ministry of Economic Affairs can apply for a TKI allowance. The TKI must fill in an application form and submit it before the closure date (15 September). The TKI

[21] Information based on the website of RVO (https://www.rvo.nl/subsidies-regelingen/topconsortia-voor-kennis-en-innovatie?wssl=1)

has the following obligations: it must make information on its projects public; keep administration records[22], manage the projects, submit information on progress and realization to RVO[23], make an annual report, and submit a request for the final determination of the allowance.

Rules of play

Public-private collaboration is organized in line with a number of general rules that have been developed by the main organizations involved in TKIs.

These rules harmonize the conditions for cooperation with the various organizations for applied research and the various divisions and foundations of the NWO organization. The harmonization relates to governance, private contributions and IPR for different types of research aimed at top sectors. The rules also provide guidance for the allocation of publicly earmarked budgets of the research organizations across the top sectors.

These rule of play harmonize and simplify public-private collaboration arrangements and give more clarity on the IPR following from public private research.

Fundamental research for the top sectors

With regard to fundamental research, the funding by the research council NWO (including STW) is important. With the introduction of the top sector approach, NWO has to earmark a significant part of its budget for research funding in the top sectors. This entailed a restructuring of the policy mix used by NWO to stimulate excellent scientific research. The NWO contribution to the top sector consists of three parts:

(1) activities specifically aimed at public-private collaboration (PPC) in the top sectors;
(2) other activities for the top sectors not specifically aimed at public-private collaboration, but following from joint public-private programming (PPP);
(3) 'free' research aimed at top sectors.

For the first (PPC) category, three models for public-private collaboration have been developed.

Model 1 (broad)	Model 2 (specific)	Model 3 (intensive)
• Broad calls across all / multiple top sectors • 1-20% private contribution • Researchers / research institutes seek support of companies for research with relevance for top sectors • Coordination by NWO[24]	• Call for one top sector (broad or one / multiple roadmaps) • 10-40% private contribution • Researchers / research institutes and companies together develop programmes that fit within the innovation contracts • Coordination by NWO / private sector / TKI	• Call or programme on one specific roadmap or a part thereof • 30-50% private contribution • Company / consortium has the lead and invites together with NWO researchers / research institutes to participate • Coordination by private sector / TKI in collaboration with NWO.

[22] This administration has to include three elements: (1) the way in which the TKI allowance is used for the execution of the collaborative projects and the innovation activities; (2) the way in which the participants deal with IP that results from these projects; and (3) the collaboration agreements.

[23] The TKI has to show RVO the actual private cash contribution for the application that the TKI has made for a specific year. This has to be done after one year (before the 1st of March in the following year) on the basis of the realization figures and collaboration contracts. A standard form has to be used.

[24] Coordination in this regard means demand-oriented programming, peer review and selection process. NWO has in all three models (shared) responsibility for the peer review and the selection process and for the administration of the awarded funding.

Note that the role of the private sector in the coordination increases from Model 1 to Model 3, which is in line with the increased private sector contributions to the research. In practice, the division of coordination tasks between NWO, the TKIs and the companies is tailored to the circumstances. Public-private collaboration means that consortia need to be open to new participants in principle.

Activities in the second (PPP) category (those following from public-private programming) concern activities by NWO that are not carried out in PPC. It is decided beforehand whether they fit within the agenda of a top sector. Five types of activities are distinguished:

(1) Thematic programs aimed at public research that follows from joint programming in TKIs;
(2) NWO institutes; deployment of their national research facilities that link up with joint programming in TKIs;
(3) Large research facilities; the connection with top sectors in one of the criteria in decisions on strategic investments in international research facilities
(4) Practice-oriented research; investments in practice-oriented research at universities of applied sciences that link up with joint programming in the TKIs
(5) European programs; co-funding of specific European collaboration programs that fit with the research agendas of the top sectors

NWO collaborates with TKI partners in the preparation of these activities.
Activities in the third category concern ‘free’ research with relevance for TKIs. NWO remains in the lead for these activities. The top sectors get more insight into how these activities relate to their top sectors. NWO and top sectors actively cooperate on initiatives that are inspired by the innovation contracts.

Applied research for the top sectors
The rules of play also concern the deployment of research capacity of the applied research institutes (in the case of Maritime technology predominantly TNO, Marin and Deltares). The total deployment of research capacity is expected to amount to about 200 million euros in 2015. This contribution is divided into two compartments: approximately 150 million euros for public-private collaboration (PPC) with private co-funding; and approximately 100 million euros for public-private programming in (PPP) the context of the innovation contracts of the TKIs / Top teams.

For applied research three collaboration models have been developed based on three categories: programmes, large projects and small projects. In practice, categories and models can be mixed.

Programmes	Large projects	Small projects
• Large consortia	• Large / medium-sized consortia with at least 2 firms	• Small consortia with one or two firms
• Duration >4 years	• Duration 1-4 years	• Duration <1 year
• Private contribution depends on type of research, but at least 10%, increasing in time to >50%	• Private contribution depends on type of research, but >50%	• Private contribution depends on type of research: fund. research >25%, industrial research >50%, experimental development >75%
• Top team (or TKI) ascertains whether programme fits with innovation contract	• Top team (or TKI) ascertains whether project fits with innovation contract	• Top team ascertains whether theme fits with innovation contract. TKI and the research institute design a selection process. Research institute decides on projects and reports to TKI
• Access of third parties after start of programme is possible in principle.	• Access of third parties after approval of consortium	• During project no access of new entrants, unless considered necessary by partners
• Combination of fundamental research and industrial research is possible	• Largely industrial research, possibly with some fundamental research and/or experimental development	• Usually industrial research or experimental development, but fund. research is possible

If the required knowledge is not available in the Dutch research system, foreign partners can be involved. Consortium partners should fund them and it is possible to use the TKI allowance already ‘earned’.

One of the objectives of the ‘rules’ is integral programming of all types of research, from fundamental research to applied research and experimental development. Integral programming can be done at four levels:

- At the level of the Top Team themes are formulated to which both NWO-funded fundamental research as well as research capacity of applied research institutes can contribute.
- Demands for knowledge in the innovation contract (roadmap) can be translated into fundamental research questions (NWO) and applied research done with/by applied research institutes.
- An integral programme can be made. The funding of projects by NWO and the deployment of research capacity by applied research institutes remains separate.
- A project with both fundamental and applied research is designed in an integral way in which NWO collaborates with an applied research institute, for example in a joint project group.)

Appendix C

Management of IPR in top sector approach: The IPR rules are aligned with the models for fundamental research and applied research:

	Fundamental research			**Applied research**		
	Broad model	**Specific model**	**Intensive model**	**Program**	**Large project**	**Small project**
Ownership **background** knowledge	Contributors remain owner of their background knowledge					
Access and use of **background** knowledge during project for participant	Royalty free, if reasonably required					
Access and use of **background** knowledge after project						
For participants	Declaration of intent combined with best efforts obligation to enable utilization / commercialization of project results					
Further research by research organization	1) Background research organization available in principle 2) Non-public background and IP other participants only with explicit approval					
For third parties	No standard rights for third parties					
Ownership **foreground** knowledge	Rights holder	(1) Rights holder (2) Optionally Central ownership (3) Commercial user	(1) Rights holder (2) Commercial user (right of first refusal)	(1) Rights holder (2) Optionally Central ownership		
Access and usage of **foreground** knowledge during project for participant	Royalty free					
Access and usage of **foreground** knowledge after project						

For participants	Know-how: Royalty free + non-exclusive IPR: Research organization in the lead, no automatic right. Specific circumstances to be taken into account by research organization	Know-how: Royalty free + non-exclusive IPR: non-exclusive (in principle)	Know-how: Royalty free + non-exclusive IPR: Royalty free non-exclusive. Option for participating firm on exclusive license for application area	Know-how: Royalty free + non-exclusive IPR: Non-exclusive in principle. Option for participating firm on exclusive license for application area	
Further research by research organization for participant	Always for own foreground, provided that no exclusive rights have been granted				
Further research by research organization for third parties	Know-how: Possible via a license with owner of know-how IPR: Possible in principle for IP of research organization. Position other participants needs to be taken into account	Know-how: Possible via a license with owner of know-how IPR: Depending on the form of collaboration third parties can get access to consortium	Know-how: Possible via a license with owner of know-how IPR: During lead time no access for third parties	Know-how: Possible in principle with entrance fee IPR: Possible in principle with entrance fee	Know-how: Impossible during project in principle, after project possible in principle with entrance fee IPR: Impossible during project in principle, after project possible in principle with entrance fee

Who was Rathenau?

The Rathenau Instituut is named after Professor G.W. Rathenau (1911-1989), who was successively professor of experimental physics at the University of Amsterdam, director of the Philips Physics Laboratory in Eindhoven, and a member of the Scientific Advisory Council on Government Policy. He achieved national fame as chairman of the commission formed in 1978 to investigate the societal implications of micro-electronics. One of the commission's recommendations was that there should be ongoing and systematic monitoring of the societal significance of all technological advances. Rathenau's activities led to the foundation of the Netherlands Organization for Technology Assessment (NOTA) in 1986. On 2 June 1994, this organization was renamed 'the Rathenau Instituut'.