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COLUMBUS
KNOWLEDGE TRANSFER FOR BLUE GROWTH

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Pilot initiative on incorporating Knowledge Transfer in a national funding agency

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Executive summary

The main objective of Deliverable 8.3 is to explore the potential of the **COLUMBUS Knowledge Transfer (KT) Methodology**, which was developed in the COLUMBUS-project, for national funding systems. Until now, the **COLUMBUS KT Methodology** was mainly applied on projects which were funded by EU-wide programmes.

In this deliverable, a two-fold approach was used:

1. The first part consists of the application of the **COLUMBUS KT Methodology** on projects from three different funding agencies in Belgium: Research Foundation - Flanders (FWO), Flanders Innovation and Entrepreneurship (VLAIO, previously IWT and AO) and Belgian Science Policy (BELSPO). In total, 33 Knowledge Outputs (KOs) from 31 projects, which can be categorised under the Monitoring and Observation Competence Node, were identified and collected, and then analysed to determine potential end-users and applications. Specific attention was paid to the first two stages of the **COLUMBUS KT Methodology** (collection and an initial analysis). Because of the differences in scale, organization and governance, it was anticipated that the experience of collection and analysis would vary most between nationally-funded projects and EU-funded projects and hence should be the focus of this study.

2. The second part of this deliverable deals with the current state and (future) needs of KT in national funding agencies. For this purpose, a screening was conducted of KT mechanisms in ongoing project programmes of Belgian funding agencies. In addition, an expert-view from BELSPO's Research Funding Programme Manager (BELSPO) on KT was captured to explore the potential for the implementation of the **COLUMBUS KT Methodology** in a national context. The same survey was submitted to experts from Project Management Juelich (PtJ, Germany) to gain more insights in differences in the KT approach in larger countries with a more complex stakeholder landscape. Although there is a significant difference in scale, existing KT mechanisms in both BELSPO and PtJ are mostly encapsulated within the projects. There is no, or limited, activity performed by external knowledge brokers.

Conclusions and findings:

- Based on this 'test-run' of the **COLUMBUS KT Methodology** on Belgian marine and maritime research projects, some barriers were identified: e.g. the lack of an up-to-date centralised project database (including KOs) with a marine/maritime focus; the absence of interim deliverables; little information about the internal project structure; and, the EU regulation on State Aid.
- **COLUMBUS KT Methodology** offers a potential blueprint for a more coherent approach towards KT and the subsequent impact monitoring in nationally-funded projects. Moreover, the **COLUMBUS KT Methodology** may have an added value as a guidance for scientists and

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other experts who are developing project proposals, allowing proposers to deal with KT in a more systematic way.

Based on the results of this exercise, the following **recommendations** were made:

- The need for dedicated marine project repositories can be met by strengthening ongoing initiatives such as Marine Knowledge Gate with information from national marine research and innovation projects;
- National funding agencies should invest in centralized open respositories with information about funded projects. Agreements on definitions, standardized metadata as well as proper technical specifications will enhance the queribility which allows an efficient extraction of marine projects (see also point above);
- Project databases should include a part describing the impact of the projects as it allows to assess where additional KT activities are needed (and where not);
- The COLUMBUS KT methodology may be refined and adapted to optimally function in a national context. As such, specific strategies and methodologies can be included to identify 'hidden' or interim KOs and to optimize transfer-efforts towards actors abroad and to actors in different sectors (cross-sectoral approach).
- With regard to State Aid, it is recommended to investigate if the transfer-stage of the COLUMBUS KT Methodology can be adapted to meet the stipulations about the non-exclusive and non-discriminatory basis: e.g. an open access database disclosing the transfer process;
- We foresee an added value for the COLUMBUS KT Methodology to include guidelines on how to deal with State Aid regulation in a national context. As such, it is highly recommended to involve legal specialists to further elucidate this topic;
- The current pilot study provides a first overview of where the COLUMBUS KT Methodology can provide added value in a national context. However, to achieve the desired conclusions and recommendations, this study needs to be expanded to more funding agencies.

1. Introduction

1.1 Project context

In recent years, Europe has invested significantly in marine and maritime research and innovation projects. In the European Commission's seventh framework programme (FP7), 1,250 marine research projects were granted with a total budget of over 3.4 billion euros (Personal Communication, EurOcean; Data Source: Marine Knowledge Gate). However, all too often valuable project results do not reach potential end-users from policy, industry, science and wider society. With the advent of the Blue Economy, the marine and maritime field is faced with grand challenges which need to be underpinned by solid science (see e.g. Navigating the Future IV and the Rome Declaration 2014). Hence, it is crucial that the generated knowledge, insights and technologies from marine and maritime research projects are valorised to their full potential. This point was also emphasised by the High Level

Group on maximising impact of EU Research and Innovation Programmes (see LAB-FAB-APP report 2017).

In this context, the COLUMBUS project (http://www.columbusproject.eu/) was initiated to capitalise on the European Commission's significant investment in marine and maritime research by ensuring accessibility and uptake of research Knowledge Outputs by end users: policy, industry, science and wider society. The project is funded under the Horizon 2020 Funding Programme with a budget of 4 million euros and is running over a period of three years (March 2015 - February 2018). The COLUMBUS consortium consists of 25 partners including scientific institutes, research funding organisations and consultancies, and is supported by an Expert Advisory Board comprising representatives from policy, industry, academia, NGOs and civil society.

The project is structured around eight "Competence Nodes" which deal with Knowledge Transfer (KT) in a specific thematic field: Fisheries Marine Physical Resources, Monitoring and Observation, Maritime Transport and Logistics, Marine Governance and Management, Marine Biological Resources, Aquaculture, and Marine Environment and Futures. The Nodes follow a custom-made methodology which was evolved within the COLUMBUS project (Section 1.2). By the end of the project, each Competence Node will produce a set of case studies that illustrate how the use of the **COLUMBUS KT Methodology** can valorise research results from EU-projects in the context of the Blue Growth or in the fields of marine and maritime policy.

1.2 The COLUMBUS Knowledge Transfer Methodology

Within the COLUMBUS project, a dedicated methodology was developed for Knowledge Transfer and the subsequent impact measurement (Deliverable 2.2). The **COLUMBUS KT Methodology** revolves around the concept of Knowledge Outputs:

> **Knowledge Output (KO)**: A unit of knowledge or learning generated by or through research activity. They are not limited to de-novo or pioneering discoveries but may also include new methodologies/processes, adaptations, insights, alternative applications of prior know-how/ knowledge.

The **COLUMBUS KT methodology** ensures that the transfer of the collected KOs is strategic, coordinated and effective. The **COLUMBUS KT Methodology** strongly builds on the efforts of the Marine Knowledge Gate (http://www.kg.eurocean.org/) which provides an overview of most of the marine and maritime projects carried out in the context of EU funding programmes (e.g. FP6, FP7, Horizon 2020). The actual KT process consists of five steps which are progressive; however as one step is implemented, it may be necessary to go back to earlier steps in light of new findings or insights.

STAGE 1: COLLECTION
Step 1. Collect Knowledge

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In this phase, KOs are identified and collected and for each of the identified outputs, a Knowledge Output Table (KOT) is completed. This table contains necessary metadata of the KOs (title, description, knowledge type, contact, link, sector, end user, potential impact, etc.) and provides an overview for each project of its KOs. Each KOT should be validated by the project coordinator who is guided through the table and complements and validates the described KOs.

STAGE 2: ANALYSE

Step 2. Analyse Knowledge

In this step, the KO is further analysed in terms of end users and potential applications. Furthermore, the output is positioned in the KO landscape: relevant authorities, influential parties (incl. roles, responsibilities & mandates). If it concerns a pre-commercial technology application, the Technology Readiness Level (TRL) can be assessed. This information helps to understand the positioning and profile of a KO and informs the development of a Knowledge Output Pathway (KOP). The pathway can be one step or a series of steps required to carry a Knowledge Output to its Eventual Impact. Where there are a series of steps, it will include detailed mapping of the steps, the users involved at each step and their predicted role in the pathway to Eventual Impact. This allows the identification of the Target User to whom KT, within COLUMBUS, should be planned.

Step 3. Profile Target User

In a third step, the identified Target User (s) are profiled because they have a specific role and responsibility which positions them to be the person best suited to apply the KO and carry it along the Knowledge Output Pathway, towards its Eventual Impact. An essential aspect in this phase is to get more insight in the Target User's mandate or responsibilities, their background knowledge, attitude, and knowledge needs, etc.

STAGE 3: TRANSFER

Step 4. Develop KT Plan

In the KT plan, the appropriate messages (technical level, language and style, background knowledge of Target User, provide examples, etc.), communication channels, materials and tools are selected and customised according to the profile of the Target User. The KT plan should also include impact measurement metrics based on the proposed Knowledge Transfer activity. A tailor-made approach will maximise the chance of successful transfer.

Step 5. Transfer and Measure

In a final step, the KT is carried out based on the KT plan. Furthermore, the impact of both the KT activity and the application of the KO by the Target User is monitored. Hence, indicators need to be in place to quantify and qualify the success of their impact. The application of each KO by the Target User and any subsequent user will be assessed and recorded in a case study.

2. Objective and strategy of the pilot initiative

Although the COLUMBUS project is primarily focused on the transfer of KOs of projects funded by EU programmes, it is clear that the **COLUMBUS KT Methodology** has significant potential to be applied on nationally-funded projects. In this deliverable, we report on the application of the **COLUMBUS KT Methodology** on a Belgian level. A number of barriers and recommendations were identified which may be taken on board to further fine-tune the methodology in order to increase its effectiveness in a national context. Conversely, these outcomes may also prove valuable for national funding agencies.

In this exercise, the **COLUMBUS KT Methodology** was applied to KOs from nationally-funded projects ('a test run of the methodology on a national level'). As Flanders Marine Institute (VLIZ) is a supporting partner in the Monitoring and Observation Competence Node, it was deemed suitable to also focus on national projects within the Monitoring and Observation field. Specific attention was paid to the first two steps of the **COLUMBUS KT Methodology** (knowledge collection and an initial analysis of the knowledge outputs up to the drafting of KOTs), as there are some differences in these steps in a national context, compared to EU-funded projects. These differences are further elaborated in this document. The subsequent phases of the KT methodology were **not** conducted within this deliverable (drafting of KOPs, development of KT plans, etc.) as the primary focus is not on the actual transfer of KOs but on exploring the differences between KT in a national and EU context. However, the completed Knowledge Output Tables (KOTs) may be taken up in the ongoing KT cycle of the Monitoring and Observation node to complete the subsequent steps: Development of KOPs, Profile Target User, Develop KT plan, and Transfer and Measure.

3. Implementation of COLUMBUS Knowledge Transfer Methodology in a national context

3.1 National (marine) funding context in Belgium and Flanders

The national funding context in Belgium is rather complex and involves both the Federal ('Belgian') level, as well as the regional or communal level ('Flanders and Wallonia'). The Belgian (marine) funding landscape is described in detail in Mees et al. (2015):

> *The division of competences for scientific research and innovation in Belgium was established in the Special law on Institutional Reforms (law of 8 August 1980). Article 6bis of this law stipulates that the federal government, the communities and the regions are responsible for scientific research within the framework of their competences, including research in pursuit of international or supranational conventions and treaties. The primary responsibility for research and innovation lies with the communities and regions. The communities are responsible for all personal matters, cultural affairs and education and training. Regional matters in the fields of economy, energy, public works, environment and transport are competences of the regions. Unlike the other regions, Flanders, the Dutch speaking northern part of Belgium, has chosen to join its community and regional competences.*

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In this task, the **COLUMBUS KT Methodology** was applied on projects funded by three different funding agencies:

1. **Belgian Science Policy** (BELSPO) (federal level): BELSPO inter alia manages the research programmes in support of the policy with regard to sustainable development, actions to address climate change, biodiversity, energy, health, mobility and the information society. Of particular importance for the marine research field, is the research programme 'Belgian Research Action through Interdisciplinary Networks' (BRAIN-be). In addition, marine research is funded by multidisciplinary programmes such as the Interuniversity Attraction Poles (IUAP). The implementation of IUAP is based on a cooperation agreement between the federal state and the communities.
2. **Research Foundation Flanders** (FWO) (Flemish level): FWO has the task of promoting and supporting fundamental research at the universities of the Flemish Community, including partnerships between the Flemish universities and other research institutes. Recently, the Hercules Foundation was also integrated in FWO which has the objective of financing medium- and large-scale infrastructures for fundamental and strategic research.
3. **Flanders Innovation and Entrepreneurship** (VLAIO) (Flemish level): a government agency, charged with implementing the economic, innovation and enterprise policy in Flanders. VLAIO is the result of a recent merge between Enterprise Flanders (AO) and the business oriented services of the Agency for Innovation by Science and Technology (IWT). In the following, most of the discussed VLAIO projects were granted by IWT.

As such, the three concerned funding agencies each have their own strategic objectives with BELSPO often oriented towards policy, FWO focusing more on fundamental and blue skies research and VLAIO (IWT) concentrating on economic valorisation.

3.2 Knowledge collection in a national context

3.2.1 A national collection of marine and maritime projects

In the COLUMBUS project, collection of KOs builds on those contained in the Marine Knowledge Gate (http://www.kg.eurocean.org/); which provides an overview of most of the marine and maritime projects that have been carried out in the context of EU-funding programmes (e.g. FP6, FP7, Horizon 2020) and some national programmes. However, in a national context, a similar dedicated marine and maritime repository is mostly lacking. Furthermore, the fragmentation of the research competences in Belgium across different policy levels adds to this problem. Hence, the first challenge was to create an overview of the marine and maritime research projects granted by the different research funding organisations.

In the case of BELSPO, a dedicated programme for the North Sea is in place which includes most (but not all) of the marine research projects. The two Flemish funding agencies, FWO and VLAIO (IWT) do not follow a programmatic approach. Hence, these agencies were not able of providing a list of projects with a marine or maritime character. Therefore, a strategy was developed to query the databases of the funding agencies. This strategy was largely based on the mapping of the Belgian marine research

landscape which is conducted annually by VLIZ in the framework of the Compendium for Coast and Sea (Pirlet et al. 2015).

This systematic mapping by VLIZ relies on semi-automated surveys of literature databases such as Web of Science and the IEEE-database. Based on keywords, journal titles and species names, marine and maritime publications with a Belgian affiliation were systematically harvested and disclosed as publication records in the Integrated Marine Information System (IMIS), managed by VLIZ. Based on the affiliations and authors of the publications, links were established in IMIS between the publication, institutes and persons. These links enabled the identification of institutes which comply with the criteria of 'marine research groups' (MRGs) and were thus included in the mapping initiative. As a result of this exercise, a systematic overview was created of the MRGs in the Belgian research landscape, in terms of their scientific output, expertise and the marine researchers. Detailed information of the mapping of the Belgian marine research landscape is given in Mees et al. (2015).

The identification of the Belgian marine researchers in the mapping initiative was a crucial element for the collection of the marine and maritime projects, funded by the Belgian research funding agencies. Based on these names, we were able to query the promotors in the databases of the research funding agencies, leading us towards the marine and maritime projects. In parallel, the databases were also queried for a number of marine and maritime keywords. In total, 305 marine and maritime projects were identified for BELSPO, VLAIO (IWT) and FWO with a starting date in the period 2008-2015. These projects were subsequently included in IMIS.

In line with the **COLUMBUS KT Methodology**, all 305 identified projects were screened according to their scope and assigned to a COLUMBUS Competence Node. Given resource limitations, it is impossible to apply the **COLUMBUS KT Methodology** to all 305 projects, it was decided to only draft KOTs and analyse the KOs of the projects which were assigned to the Marine Monitoring and Observation Competence Node[1]. In total, 31 projects were allocated to this Node (13 VLAIO (IWT) projects, five FWO projects and 13 BELSPO projects, see Annex 1). As these projects were spread across numerous programmes within the three funding agencies, we are confident that this thematic approach does not impede to draw more general conclusions.

3.2.2 Collecting Knowledge Outputs of the identified marine and maritime projects

Subsequent to the identification of the 31 national projects in the Marine Monitoring and Observation Competence Node, the KOs of these projects had to be collected. Due to the fragmentation of the competences with regard to research across various policy levels, there is no central database where all research outputs of Belgian (and Flemish) projects are recorded. As a result, several databases and information sources had to be screened and queried.

For BELSPO projects, there is a dedicated project database: FEDRA. A screening of FEDRA revealed that eleven of the 13 identified marine and maritime BELSPO projects relevant to Marine Monitoring and

[1] As VLIZ is a supporting partner in the Monitoring and Observation node of COLUMBUS, the relevant KOs that are identified in the national marine and maritime projects can feed into the ongoing KT-cycle of this node.

Observation were effectively included. For each of these eleven projects, a project description is given and the involved partners are mentioned. When project documentation was reviewed (e.g. deliverables, reports, publications, etc.) to identify KOs, information was only available for six of the projects. Hence, other information channels were consulted; such as project websites (seven out of 13 projects) and other databases (six out of 13 projects). Information was found on all BELSPO projects; however, KOs could only be collected for nine out of 13 projects. In this context, it is noted that the project coordinators were not contacted due to the limited timing of this deliverable.

The Flemish research funding agencies (FWO and VLAIO) do not have their own public project database. However, on the Flemish level, the FRIS research portal was established to disclose the expertise and output of the Flemish researchers. This portal has a specific module for research projects which can be linked to researchers, organisations and funding programmes. As this portal is still a work in progress, it is far from complete. In addition, there is currently no link between research projects and the KOs of the project.

- A project description was found for four out of five FWO projects in the FRIS database. However, for none of these projects could KOs be identified in FRIS or in other information sources and databases. No dedicated websites were found for FWO projects.
- A description was included in the FRIS database for only two of the 13 identified projects. For four out of the 13 VLAIO projects. KOs could be identified from other information sources and databases. No dedicated websites were found for VLAIO (IWT) projects.

In total, 33 KOs were collected for the 31 national projects which were identified as relevant to the Marine Monitoring and Observation Competence Node (see Annex 1). As apparent from Annex 1, in some projects multiple KOs could be identified, whereas, in other projects no information was found.

It can be stated that the absence of up-to-date and centralised public project databases which also include the produced KOs, constitutes a significant barrier to effectively apply* the COLUMBUS KT methodology *at a national level. Also, agreements on definitions and the necessary metadata for a more standardised project description are much needed and would improve the search and discovery functionality of databases (cf. Frascati Manual). Moreover, such databases should meet certain technical specifications to allow for bulk queries (of basic metadata such as title, keywords, project description, partners, promotor(s), timing, etc.) and the export of the results in a suitable format (e.g. excel, XML, JSON, etc.).

Furthermore, it would be valuable to include an **impact** section in project databases as it would allow to quickly assess where additional KT-activities are needed (and where not) (see also section 3.3). In this regard, Researchfish (https://www.researchfish.net/) which was initiated in the UK can be mentioned as an example of good practice. This 'Research Impact Assessment Platform' enables research funders and Research Organisations to track the impacts of their investments, and researchers to log the outputs, outcomes and impacts of their work.

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3.2.3 Availability of Knowledge Outputs in research projects involving industry

While in some cases one may wonder why the KOs of the projects were not publicly disclosed, there is often a good reason not to do so. In the case of VLAIO (IWT) – which primarily has an economic perspective – a dedicated policy was drafted relating to the use of results generated by the funded projects. In this context, specific attention was paid to the relationship between research institutes and companies.

Depending on the research programme, different modalities are in place. In programmes that focus on research and innovation close to the market and a high valorisation potential, research institutes are often not positioned to publicly disclose their results. In the latter case, the intellectual property (IP) generated is protected using Intellectual Property Rights (IPR) made available only to the project partners to protect the valorization potential for the involved companies.

Furthermore, the policy that was drafted by VLAIO (IWT) on KT is heavily determined by the preconditions that are imposed by the EU regulation on State Aid (see section 4.1). Especially Section 2.2, "*Indirect State aid to undertakings through public funded research and knowledge dissemination organisations and research infrastructures*", that provides specific stipulations for joint collaborations between research organisations and undertakings.

As the transfer of KOs from science to industry is a complex matter, Belgian universities increasingly invest in technology transfer services which offer services such as providing (legal) advice, managing the IP from scientists, guiding the creation of spin-offs and licensing and identifying funding opportunities (see e.g. https://www.ugent.be/techtransfer/en and https://lrd.kuleuven.be/en). An interesting element in the context of KT, is the Industrial Liaison Networks which were set up at Ghent University which *inter alia* focus on marine topics such as Aquaculture Ghent University (Innovations for a sustainable aquaculture production) and Sustainable Energy Technologies (including Blue Energy).

3.3 Knowledge Collection and initial analysis of KOs

21 Knowledge Output Tables (KOTs) were drafted for the identified KOs from national projects, relating to the Marine Monitoring and Observation Competence Node. As a supporting member of the Monitoring and Observation node, VLIZ was also involved in the drafting of KOTs for European projects. Therefore, a first assessment of the differences between drafting KOTs for national compared to EU projects could be made. These findings touch on some barriers and may also help to fine-tune the **COLUMBUS KT Methodology** for a national context.

- In contrast to EU-funded projects, there is **hardly any information about the internal structure of national projects** (i.e. work packages and/or deliverables). This makes it much more difficult to get a grasp on 'interim deliverables' or 'methodological developments' which may be valuable as stand-alone KOs. For most of the national projects, only the final report is available. This approach was also confirmed by BELSPO's Research Funding Programme Manager (Section 5.2).

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- In line with the previous point on the interim deliverables, the national projects have **fewer standalone KOs** as they are in general more focused on one or two final deliverables (end products).
- As the national projects are **more focused on a single end-product or application** (and perhaps tuned to end user needs), the result is often easier to 'sell' to end users, as the potential is immediately clear. This may also explain that a significant number of the identified (IWT) projects produced KOs which already evolved into commercial products (see Annex 1).
- As already mentioned in Sections 3.2.2 and 3.2.3, often no project website was available. Moreover, the **information** of national projects (project descriptions, outcomes, etc.) **is mostly fragmented** (little or no centralization).
- Several of the scanned projects have already evolved into a commercial product. However, this kind of information was never centralized available. It would be very valuable to include this information in the central project database of the research funding agencies as it would allow to assess where additional KT-activities are needed. Moreover, it would also emphasize the impact of a certain project.
- **Ongoing national projects rarely report about progress**, even if a website is available. In addition, it is not clear how to deal with 'high-potential expected deliverables' of ongoing projects. Sometimes the work plan of a project describes KOs which will be developed in the (near) future. Can a knowledge broker bring potential end-users in contact with a project consortium while a KO is still being developed?
- Some of the KOs of national projects are produced in the context of **(post) doctoral research**. These results are rarely disclosed on a website or in a centralized database. Hence, you have to dig into publication lists to find potential outputs. This can prove too time-consuming to be effective.
- In a lot of the national projects, **KT mechanisms are in place** and the potential end-users are already involved in the project as a partner or as a member of the **guidance committee/end-user group** (see also Sections 5.1 and 5.2). Obviously, it is much easier to involve most of the potential end-users on a national compared to a EU-scale.
- As a consequence of the previous point, the KOs produced by national research projects often have **particular potential if transferred to actors abroad** (as the relevant national players may already be involved). However, especially in the funding channels with an economic perspective, the aim is to establish a competitive advantage for Flanders (Belgium); hence, one can speculate that KT to foreign actors may not be encouraged. On the other hand, this activity may contribute to an internationalisation strategy of innovative applications.
- As in a lot of cases, the most evident potential end-users are already involved in the national projects (as a project partner or in the guidance committee/end-user group), the knowledge broker may **have an added value in identifying less obvious applications in different fields** (cross-sectoral approach).

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4. Legal restrictions on Knowledge Transfer in EU Member States: EU legislation on State Aid

When the KT process is conducted by public bodies or organisations, one must ensure that the (European) legislation relating to State Aid[2] is respected (see: http://ec.europa.eu/competition/state_aid/legislation/legislation.html).

State Aid is defined as an advantage in any form whatsoever conferred on a selective basis to undertakings by national public authorities. To be State aid, a measure needs to have the following features:

- There has been an intervention by the State or through State resources which can take a variety of forms (e.g. grants, interest and tax reliefs, guarantees, government holdings of all or part of a company, or providing goods and services on preferential terms, etc.);
- The intervention gives the recipient an advantage on a selective basis, for example to specific companies or industry sectors, or to companies located in specific regions;
- Competition has been or may be distorted;
- The intervention is likely to affect trade between Member States.

Hence, if a public body transfers KOs (*intervention by the State*) to a specific company (*selective basis*) which may lead to a competitive advantage (*distortion of competition which may affect trade between Member States*), this may be considered State Aid.

However, the Treaty on the Functioning of the European Union (TFEU) leaves room for a number of policy objectives for which State Aid can be considered compatible. Below, the EU Framework for State aid for research and development and innovation and the concept of Services of General (Economic) Interest are discussed. These include exemptions which may be relevant for the implementation of the **COLUMBUS KT Methodology** on the level of Member States.

4.1 EU Framework for State aid for research and development and innovation

The EU Framework for State aid for research and development and innovation (2014/C 198/01) stipulates the rules to which research organisations (or infrastructures) have to adhere to comply with the State aid legislation. It is important to note that unlike nationally-funded reseach, EU-funded programmes such as Horizon 2020 are outside the scope of the framework. However, whenever an EU-funded project is co-financed by a national or regional government, it has to adhere to the stipulations of the EU Framework for State aid for research and development and innovation.

The framework includes a specific definition of inter alia 'knowledge transfer' and the related concept of 'innovation advisory services'.

[2] Section 4 is largely based on the input that was received from legal experts from VLAIO and was also endorsed by the opinion of the legal team of DTU-Aqua.

*'**Knowledge transfer**' means any process which has the aim of acquiring, collecting and sharing explicit and tacit knowledge, including skills and competence in both economic and non-economic activities such as research collaborations, consultancy, licensing, spin-off creation, publication and mobility of researchers and other personnel involved in those activities. Besides scientific and technological knowledge, it includes other kinds of knowledge such as knowledge on the use of standards and regulations embedding them and on conditions of real life operating environments and methods for organizational innovation, as well as management of knowledge related to identifying, acquiring, protecting, defending and exploiting intangible assets.*

*'**Innovation advisory services**' means consultancy, assistance and training in the fields of knowledge transfer, acquisition, protection and exploitation of intangible assets, use of standards and regulations embedding them.*

With regard to the implementation of the **COLUMBUS KT Methodology**, part 2.1 and 2.2 of the Framework are especially interesting. Below, some of the relevant stipulations are included.

2.1 Research and knowledge dissemination organisations and research infrastructures as recipients of State aid

…

The Commission considers that the following activities are generally of a non-economic character:
(a) Primary activities of research organisations and research infrastructures, in particular:

- *…*
- *wide dissemination of research results on a non-exclusive and non-discriminatory basis, for example through teaching, open-access databases, open publications or open software.*

(b) knowledge transfer activities, where they are conducted either by the research organisation or research infrastructure (including their departments or subsidiaries) or jointly with, or on behalf of other such entities, and where all profits from those activities are reinvested in the primary activities of the research organisation or research infrastructure. The non-economic nature of those activities is not prejudiced by contracting the provision of corresponding services to third parties by way of open tenders.

Hence, research organisations should disseminate KOs on a non-exclusive and non-discriminatory basis. If an organisation generates profit from a KT activity, it should be re-invested in the research activities.

2.2 Indirect State aid to undertakings through public funded research and knowledge dissemination organisations and research infrastructures

…

2.2.2 Collaboration with undertakings

Where collaboration projects are carried out jointly by undertakings and research organisations or research infrastructures, the Commission considers that no indirect State aid is awarded to the participating undertakings through those entities due to favourable conditions of the collaboration if one of the following conditions is fulfilled:

(a) the participating undertakings bear the full cost of the project, or

(b) the results of the collaboration which do not give rise to IPR may be widely disseminated and any IPR resulting from the activities of research organisations or research infrastructures are fully allocated to those entities, or

(c) any IPR resulting from the project, as well as related access rights are allocated to the different collaboration partners in a manner which adequately reflects their work packages, contributions and respective interests, or

(d) the research organisations or research infrastructures receive compensation equivalent to the market price for the IPR which result from their activities and are assigned to the participating undertakings, or to which participating undertakings are allocated access rights. The absolute amount of the value of any contribution, both financial and non-financial, of the participating undertakings to the costs of the research organisations or research infrastructures' activities that resulted in the IPR concerned, may be deducted from that compensation.

…

Hence, research organisations should distribute the non-commercial KOs which result from the collaboration with undertakings widely. Furthermore, the IPR resulting from these projects are allocated to the project partners. When IPR which was generated by a research organisation is transferred, the organisation has to receive a market price for this IPR.

4.2 Service of General (Economic) Interest

Under the concepts of Service of General Interest (SGI) or Service of General Economic Interest (SGEI), State aid may be regarded as compatible with the Treaty on the Functioning of the European Union (TFEU) (more information: SWD(2013) 53 final/2):

- SGIs are services that public authorities of the Member States at national, regional or local level classify as being of general interest and, therefore, subject to specific Public Service Obligations (PSO).

- SGEIs are economic activities which deliver outcomes in the overall public good that would not be supplied (or would be supplied under different conditions in terms of objective quality, safety, affordability, equal treatment or universal access) by the market without public intervention. In this context, a PSO is imposed on the provider by way of an entrustment and on the basis of a general interest criterion which ensures that the service is provided under conditions allowing it to fulfil its mission.

Hence, under certain conditions a national, regional or local government can assign specific public service obligations to an organisation to perform knowledge transfer and this may qualify as an SG(E)I.

4.3 Conclusion

From this initial screening of the EU legislation on State Aid, we may conclude that the implementation of the COLUMBUS KT Methodology on the level of EU Member States has to adhere to certain rules and principles. In order to be compatible with State aid, the COLUMBUS KT Methodology should have a non-exclusive and non-discriminatory basis, the appropriate remuneration has to be foreseen for IPR and/or a specific mandate from a national, regional or local government is needed to qualify as an SG(E)I. Especially the stipulations about the non-exclusive and non-discriminatory basis may have implications for the transfer-stage of the COLUMBUS KT Methodology. One could think about disclosing the various steps of the transfer process in an open-access database to make the methodology compatible with State Aid on the level of the Member States. In turn, care should be taken that this inclusive approach does not devaluate the effectiveness of the KT approach. However, further legal advice is needed to draw final conclusions.

5. Knowledge Transfer in national funding agencies: current status and (future) needs

According to the European Semester thematic fiche[3] on 'Research and Innovation', Belgium is one of the European countries with the strongest science base. However, a key challenge is to translate this world class science base into an increased level of innovation in the economy. Hence, an efficient KT mechanism may contribute to an increased economic valorisation of this scientific potential. Still, this is only a part of solution. The thematic fiche concludes that the main problem is the lack of fast-growing firms in innovative sectors. This impedes the full translation of the strengths of its Research and Innovation (R&I) system into economic performance. The thematic fiche further stipulates that although well-designed policies enabled business Research and Development (R&D) intensity to increase in Belgium, R&D remains too concentrated in a limited set of large multinationals.

[3] The Commission issues 28 "thematic fiches" comparing Member States' performance in the main policy areas relevant to boost investment, accelerate structural reforms and pursue responsible growth friendly fiscal consolidation.

In the following, an overview is given of the existing KT mechanisms in national project programmes. Furthermore, an expert-view from BELSPO's Research Funding Programme Manager on KT was captured and the potential for the implementation of the **COLUMBUS KT Methodology** was explored. In addition, the survey was also submitted to experts from Project Management Juelich (PtJ, Germany) to gain more insight in differences in the KT approach in larger countries with a more complex stakeholder landscape.

5.1 Existing Knowledge Transfer mechanisms in national project programmes

5.1.1 Belgian Science Policy (BELSPO)

In the BRAIN-be-call of 2016 that was issued by BELSPO, specific stipulations for KT were included in the regulations for the proposals. Each consortium should assess the relative importance of the expected results for the following user groups: scientific/research community, policy support/policy makers and societal/society in general. The proposal should include dissemination and valorisation tasks towards these end users.

Furthermore, the regulations stipulate that each project has to be accompanied by a follow-up committee. The objective of this committee is to provide active follow-up of the project and to ensure valorisation of the research. It will carry out this role through the exchange and provision of data and information, giving advice, suggesting possibilities to valorise the research, etc. The follow-up committee is composed of potential users of the results, such as representatives of public authorities at national, regional, European, or international level, social actors, scientists, industrial actors, etc. The members of the follow-up committee are non-funded. It is up to the candidates to specify in their proposal the functioning and specific goals of the committee (number of meetings, method of information exchange, etc.), and the role and profiles of its members. To the extent that possible members will be identified by name and, if applicable, will express their interest and possible contribution to the project. The final composition of the follow-up committee will be defined in collaboration with BELSPO.

5.1.2 Flanders Innovation and Entrepreneurship (VLAIO)

As also discussed in the section about 'the availability of KOs in research projects involving industry', in programmes which deal with research and innovation close to the market, the generated IP remains within the project consortium. In the latter case, KT is restricted to the project partners in order not to jeopardise the competitive advantage of the involved companies.

Some IWT-programmes[4] - where IWT combined with another organisation to become VLAIO - also deal with research which is not considered close to the market. It concerns programmes for innovative research with a prospect of an economic application in the future or research with specific societal applications. In these programmes, it is recommended (although not mandatory) to install a guidance

[4] Most of the VLAIO-projects which are discussed in this report (2008-2015), were granted by IWT (which recently merged with Enterprise Flanders (AO)). Some IWT-programmes have also been transferred to FWO.

committee with potential end-users from industry or society to facilitate KT. In turn, the members of the committee can also provide input on the application potential of the results. An important element is that in general these committees are 'open entities' which do not have exclusive rights to potential exploitation. However, in some cases exclusive access for certain members of the committee to specific results, cannot be avoided. In the latter case, it should be ensured that this exclusive access does not disrupt the dynamics of the guidance committee. If a committee consists of companies with overlapping valorization niches, no exclusive rights can be granted.

5.1.3 Research Foundation Flanders (FWO)

As FWO is more oriented towards fundamental and blue skies research, not a lot of emphasis is placed on KT in FWO-research projects. In the project application, the applicants must include whether their research is suitable to be communicated to non-experts and how this communication should be undertaken. In this regard, FWO encourages the wide dissemination and, if possible, valorisation of the generated research results. Furthermore, the number of articles that was published by the project in international peer-reviewed journals is included in the evaluation criteria. Hence, in FWO-research projects the KT is primarily focused on other scientists.

FWO also has an active open access policy. Following the Berlin Declaration of 2003 for the promotion of free access to scientific knowledge and cultural heritage, beneficiaries of FWO must deposit their publications in a public "Open Access" database, within one year from the date of publication, in order to effect greater impact and valorisation of their work. Researchers are also advised to publish their other publications in such an "Open Access" database, the so-called "Open Archives", together with the research data that resulted in these publications.

5.2 Expert-view on KT in a national context

To further elucidate the existing KT mechanisms and to explore the potential to implement the **COLUMBUS KT Methodology** (parts of) in a national context, David Cox – (marine) programme manager of BELSPO – was interviewed. The most relevant findings and observations are included below. An important aspect which needs to be taken into account is that BELSPO generally focuses on scientific projects without the primary target of going high into the TRL-scale, as is the case for VLAIO. As apparent from the scanning of existing knowledge transfer mechanisms in national project programmes (section 5.1), this may affect the way the KT-system is conceived within a funding agency. Hence, this precondition should be taken on board in the following.

In addition, the same questions were submitted to experts from Project Management Juelich (www.ptj.de, Germany) in order to get a better view on differences as well as similarities in the approach of the KT process in larger countries with a more complex stakeholder landscape.

5.2.1 Survey BELSPO

Target audience of BELSPO

BELSPO traditionally used to target scientists and the policy level. More recently, a broader approach is used, which also includes society at large as well as industry. In the current situation, the target audience of a specific project is determined in the proposal by the partners of the consortium.

Status of KT in BELSPO

Until 10 years ago, the main focus was on the final report, (peer-reviewed) publications and presentations in conferences. At present, a specific policy with regard to KT is in place in BELSPO. The following elements are included in this policy:

- The mechanism of end-user committees (or guidance committees) is obligatory for every project and allows for an interaction between the project consortium and stakeholders. Hence, the KT process is encapsulated in every BELSPO-project;
- A policy with regard to open access publications (for 5 years) and open data (since 1999) is in place;
- A dissemination/valorisation plan has to be included in the project proposal. This plan is also assessed when the proposal is reviewed;
- A final report that is disseminated through the FEDRA-database (there are almost no interim reports).
- While most of the KT is encapsulated within the projects, BELSPO – as an organisation – also stimulates KT by means of conferences and the 3-monthly publication 'Science Connection'.

As every project organises KT in its own way, a need for a more coherent approach is identified. General instructions on how to conduct KT are deemed necessary. In this context, the **COLUMBUS KT Methodology** which was developed within COLUMBUS could serve as an inspiration or blueprint.

Role of (external) knowledge brokers

KT of results from BELSPO-projects by an external knowledge broker (which is not part of the project or the involved funding agency) occurs on an ad hoc basis. An example is the initiative of the Compendium for Coast and Sea which is an integrated knowledge document on the socio-economic, environmental and institutional aspects of the Coast and Sea in Flanders and Belgium.

There is no need to systematically involve an overarching (external) knowledge broker as the current approach seems sufficient. The mechanism of the end-user committee within the projects works well in a smaller country such as Belgium, as there is a good view on the relevant parties which should be involved. In larger countries with a larger and more complex stakeholder landscape, this may be different.

The success of KT within a project also largely depends on the level of commitment of the partners towards the end-user committee. Moreover, the best results were achieved by project partners which have the appropriate communication skills (tailored communication towards end users). In this

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context, BELSPO has considered to organise workshops to increase the communication skills of the involved scientists.

Barriers in the KT process

Two main barriers were identified which may hamper the KT process:

- Researchers are often reluctant to comply with the BELSPO-policy on open data as they first want to publish their results. In order to solve this issue, an embargo-period of two years was introduced;
- The project consortium is sometimes hesitant to share their results with the end-user committee as they fear that their ongoing work may be distributed before publication.

Impact monitoring

BELSPO does not systematically monitor the impact of the projects. The hits and downloads on the FEDRA-database are recorded but these figures are not interpreted. The potential impact is assessed in the proposal (a priori) but not after the project (a posteriori). Hence, the **COLUMBUS KT Methodology** for measuring KT impact may be useful in this regard.

5.2.2 Survey Project Management Juelich (PtJ)

Objectives and target audience of PtJ

PtJ is one of the leading project management agencies in Germany, working in close collaboration with ministries and public authorities, as well as scientific institutions, society and industry. The organisation has more than 1.000 employees, spread over 4 office locations in Germany (Juelich, Bonn, Berlin and Rostock). PtJ is supporting the German federal and state governments and is collaborating with the European Commission in achieving their funding policy objectives. On behalf of the clients, the organisation is implementing research and innovation funding programmes that have been tailored to meet their specific requirements and address socio-political needs.

Within programmes supporting research and innovation, PtJ allocated some € 1.41 billion of funding during the 2015 financial year on behalf of the several German Federal authories and Länder.

PtJ covers a wide range of services in the area of research and innovation management and as a competitively neutral institution, the organisation combines scientific and administrative competences:

- Analysis of scientific and technological trends
- Moderation and development of innovation strategies
- Development of funding concepts and guidelines
- Implementation of funding programmes
- Coordination of European and international funding initiatives
- Control of review and evaluation processes

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- Advice on national and European research funding
- Research communication

On behalf of German federal and state ministries, and the European Commission, PtJ coordinates research and innovation funding programmes in the following areas:

- Life Sciences
- Energy
- Materials technologies
- Environment and sustainability, climate protection
- System Earth
- Navigation and marine technology
- Regional technology platform
- Technology transfer and Business Start-Ups
- European research management
- International cooperation

Status of KT in PtJ

Due to the wide range of funding themes and clients as well as target groups (primarily science and industry), a common KT strategy doesn't exist. Mostly, KT activities are part of the respective funding call, and the respective grantee is responsible to tackle those activities within the framework of the project. A plan on how the project results should be 'exploited' (to support science, society, industry or politics) has to be delivered with the project application. During the course of the funded project, the project coordinator has to show-case that the consortium is following the plan. At the end of the project, the funding agency must check if the plan was implemented and if KT activities (e.g. publications) are published or in preparation. The funding agency is mandated to follow-up on the planned implementation up to 5 years after the project ended. The process of research funding as well as following up on the knowledge transfer (exploitation plan) is part of the internal quality management. Apart from the KT, a regular exchange with the contracting authority (e.g. federal ministries) takes place to elaborate on future research topics and technology trends. The discussions are also based on recent scientific findings. One could presume that knowledge transfer to especially science and policy is taking place regularly as part of the daily work of PtJ.

For several years, a federal database on publicly funded projects in Germany (www.foerderkatalog.de) with more than 110,000 current and finalised projects is available online. Unfortunately, the knowledge outputs of a project are not provided.

Depending on the research topic and the funding ministry, the results of scientific projects are also published through several web-portals. In respect of the environmental research, the framework programme "Research for Sustainable Development" (FONA) is presenting high-potential knowledge outputs on their website.

In September 2016, the Federal Ministry of Education and Research has published its Open Access-Strategy. This was an important step to foster the access to scientific knowledge for the wider society.

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Furthermore, internal data management systems are already implemented or will be implemented in due time in the individual divisions of PtJ. The marine research division collects information about scientific results of the funded projects (e.g. publications, new methodologies, etc.) and capacity building project results (e.g. master- or PhD-theses, lectures).

Role of (external) knowledge brokers

KT activities are manifold and range from dissemination to tech transfer. A successful KT is often a mix of activities and people involved. Due to the aspect of innovation, the impact is sometimes unforeseeable. The role of a knowledge broker is a quite new concept and PtJ foresees the following aspects in this context:

1. KT to be mainly coordinated and implemented by the project coordinator. This is especially valid if the project's outputs mainly consist of scientific papers, master or PhD theses.
2. Results and thus the subsequent KT from industry/technology focused projects are usually owned by the leading industry partners and the respective exploitation of results are implemented within the project's consortia.
3. Involvement of a KT broker is necessary if the project results can be used transdisciplinary or with end users which have not been planned for in the first place.
4. According to PtJ, the involvement of professional KT experts is not yet commonly accepted in the scientific community.

Barriers in the KT process

As a main barrier, PtJ refers to the so-called innovation gap (more information on the concept of the innovation gap). However, several funding programmes are already in place in Germany to address this gap. For example:

- EXIST – University-Based Business Start-ups (https://www.ptj.de/exist-en);
- Entrepreneurial Regions (https://www.ptj.de/entrepreneurial-regions): The BMBF innovation initiative for the New German Länder "Entrepreneurial Regions" aims to establish and expand the technological competence of regions and implement this competence in innovations;
- WIPANO - Transfer of knowledge and technology through patents and standards (https://www.ptj.de/wipano).

Furthermore, several technology transfer experts are working at PtJ to overcome some of the barriers in the KT process. It inter alia concerns the scientific managers of the respective funding programmes, the PR-department and specific persons in each department. Furthermore, PtJ is member of TAFTIE, the European Association of leading national innovation agencies (www.taftie.org).

Impact monitoring

In order to ensure that project results reach the end user, the grantee has to prove that the respective exploitation plan of KT has been implemented, and the impact measured. The impact measurement is tailored to the specific funding programme. PtJ has profound experiences with external evaluations,

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whether in the position to provide information about the funded projects to the evaluator or as evaluator in charge.

5.2.3 Discussion results survey BELSPO and PtJ

Although BELSPO and PtJ are both research funding/management agencies, there is a significant difference in scale between the organisations. Nevertheless, similarities for several aspects of the KT process, could be identified:

- The KT process of BELSPO is almost entirely encapsulated within the projects, with a central role for the end-user committees. This approach works well in the Belgian context as there is a good view on the end users and stakeholders that should be involved in these committees. Although the stakeholder landscape is much more complex in a large country such as Germany, the survey with PtJ also demonstrates a central role for the project consortium in the German case.
- In both cases, centralised project databases are present. However, significant progress can be made to also disclose (interim) KOs. This can be considered an important element in the implementation of the Open Access policy which is in place in BELSPO and at the level of the German Federal Government.
- Neither BELSPO nor PtJ possess a general methodology to approach the KT process. BELSPO identified the need for general instructions for KT in the BELSPO-projects. Hence, the **COLUMBUS KT Methodology** may prove useful in this context. PtJ mentioned that the wide range of their activities may impede a common methodology.
- With regard to (external) knowledge brokers, both organisations see an important role for the project consortium. PtJ and BELSPO also undertake a (limited) role in the dissemination of KOs. External knowledge brokers were not deemed necessary by BELSPO, whereas PtJ points out that this concept is currently not commonly accepted in the scientific community. PtJ also highlights the added value of a knowledge broker to establish a transdisciplinary approach to the KT process. This ties back to the observation which was made in section 3.3 that a cross-sectoral approach may be particularly useful in a national context.
- The barriers brought forward by BELSPO have a specific scientific perspective (fear of dissemination of project results before publication), whereas PtJ primarily focuses on how to address the innovation gap.
- In BELSPO, no systematic monitoring of the impact of projects is in place. Hence, this may add to the usefulness of the **COLUMBUS KT Methodology**, which includes an impact-measurement-component. The wide range of activities of PtJ entail that the impact monitoring is tailored to the specific funding programme.

As already mentioned, these results may be skewed due to the fact that BELSPO is primarily focusing on scientific projects rather than technology development projects. Indeed, it is clear that funding agencies such as VLAIO which focus on economic valorization have different KT-mechanisms in place (see section 5.1). Hence, care should be taken when generalizing some of the outcomes above.

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6. Conclusions and recommendations

Based on this pilot initiative, we can draw several conclusions and formulate some recommendations with regard to the implementation of the **COLUMBUS KT Methodology** in a national context.

- The ***availability of a national repository for marine and maritime projects and their Knowledge Outputs*** seems indispensable to systematically implement a KT process. In the Belgian case, this repository was developed by Flanders Marine Institute (VLIZ), based on an extensive mapping of the marine research landscape (see Compendium for Coast and Sea; Pirlet et al. 2015). We are aware that these kinds of marine and maritime project repositories and/or systematic mapping initiatives are lacking in most countries. This proves to be a significant barrier in the implementation of the **COLUMBUS KT Methodology**.

> ***Recommendation**: Strengthen existing European marine project databases with information from national research and innovation projects. An example is the Marine Knowledge Gate (http://www.kg.eurocean.org/) which already collates information on some national marine and maritime projects but may consider to increasingly expand its efforts. As such, incentives are needed to gain support from the national funding agencies to assist in collating the appropriate information (see also following point).*

- The ***lack of up-to-date (centralised) public project information***, constitutes a significant barrier to effectively apply the **COLUMBUS KT Methodology** on a national level.

> ***Recommendation**: National funding agencies should invest in centralized open repositories with information about funded projects. Agreements on definitions and the necessary metadata for a more standardised project description are much needed and would improve the search functionality of databases (cf. Frascati manual). Moreover, such databases should meet certain technical specifications to allow for bulk queries (of basic metadata such as title, keywords, project description, partners, promotor(s), timing, etc.) and the export of the results in a suitable format (e.g. excel, XML, JSON, etc.). This also ties back to the first recommendation to allow the extraction of marine projects from national databases. It is recommended to also include information of the impact of projects in these databases (spin-offs, commercial products, patents, etc. which evolved from the project) as it would allow to quickly assess where additional KT-activities are needed (and where not). In this regard, ResearchFish (https://www.researchfish.net/) which was initiated in the UK can serve as an example of good practice.*

- The structure, governance, deliverables and KT process of the Belgian ***national projects revealed major differences compared to projects funded by EU programmes***:

- In general, there is ***hardly any information about the internal structure*** of national projects (WPs and deliverables) and there are ***fewer interim-deliverables***. In most cases the final report is the only mandatory deliverable.
- A similar obstacle was met when identifying KOs that are the result of ***(post) doctoral research*** and remain hidden in scientific publication lists.
- A ***project website is often lacking*** on a national level. This finding also ties back to the need for up-to-date public project databases.
- In a lot of national projects, efficient KT mechanisms are in place as this is much easier to manage on a national scale, compared to the EU context. Therefore, the output of national research projects often holds ***particular potential to transfer KOs to actors abroad*** (as the relevant national players are already involved in the project).
- In a lot of cases, the most evident potential end-users are already involved in the national project (see also above), the knowledge broker may have an added value in identifying less obvious applications in different fields (**cross-sectoral approach**).

Recommendations*: It should be investigated how the COLUMBUS KT methodology can be refined and adapted to optimally function in a national context. Specific strategies and methodologies can be developed to better identify 'hidden' or interim KOs (in final reports or (post) doctoral research) and to direct transfer-efforts towards actors abroad and to actors in different sectors (implementation of a cross-sectoral approach).*

- Within this national pilot initiative, it became clear that legal restrictions on KT in EU Member States which are related to the ***EU legislation on State Aid*** should be taken on board. As this legislation is quite complex, it would be a significant added value for the **COLUMBUS KT Methodology** if recommendations/guidance on this topic would be provided. In order to be compatible with State aid, the **COLUMBUS KT Methodology** has to adhere to certain rules and principles:
  - The methodology should have a ***non-exclusive and non-discriminatory basis***;
  - The ***appropriate remuneration*** has to be foreseen for IPR;
  - A specific mandate from a national, regional or local government is needed to qualify as a ***Service of General (Economic) Interest*** (SG(E)I).

Recommendation*: It is recommended to investigate if the transfer-stage of the* ***COLUMBUS KT Methodology*** *can be adapted to meet the stipulations about the non-exclusive and non-discriminatory basis. One could think about disclosing the various steps of the transfer process in an open access database to make the methodology compatible with State Aid on*

the level of the Member States. In turn, care should be taken that this inclusive approach does not devaluate the effectiveness of the KT approach. Finally, we strongly advise involving legal specialists to further refine this part of the ***COLUMBUS KT Methodology****.*

The screening of national project programmes and the expert-view on KT in a national context (BELSPO and PtJ) demonstrated that when ***KT mechanisms*** are in place, they are mostly ***encapsulated within the projects***. In this regard, a central role is attributed to end user or guidance committees. This approach works well in the Belgian context as there is a good view on the end users and stakeholders that should be involved in these committees (although impact measurements are lacking). While the stakeholder landscape is much more complex in a large country such as Germany, the survey with PtJ also demonstrates a central role for the project consortium in the German case.

External knowledge brokers were not deemed necessary by BELSPO, whereas PtJ points out that this concept is currently not commonly accepted in the scientific community. PtJ also highlights the added value of a ***knowledge broker to establish a transdisciplinary approach*** to the KT process. This ties back to the observation that a cross-sectoral approach may be particularly useful in a national context.

The ***need for general instructions for KT in a national context*** was identified for the case of BELSPO. The **COLUMBUS KT Methodology** may prove useful in this context, and can also serve as an inspiration or blueprint to establish a systematic monitoring of the impact of BELSPO-projects.

As a final observation: When the **COLUMBUS KT Methodology** is further refined to comply with the national context (including recommendations on how to deal with the State Aid regulation), it holds ***great potential as guidance for scientists and other experts who are developing project proposals***. In this way, the project developer could be instructed on how to deal with KT in a structured way in the proposal.

Recommendation: *The current pilot study provides a first overview of where the* ***COLUMBUS KT Methodology*** *can provide added value in a national context (e.g. blueprint with general instructions for KT, guidance to implement KT in project proposals, etc.). However, to achieve the desired conclusions and recommendations, this pilot study would need to be expanded to further funding agencies. As this would exceed the lifetime of the COLUMBUS project, a COLUMBUS Legacy Working Group was established. The partners involved will develop a "Blue Society Knowledge Transfer Handbook" containing methods, good practice, case studies and standards that can be adopted in such an environment.*

Annex 1 – Belgian Monitoring and Observation projects + identified KOs

Project name	Funding agency	KO title	KO type	KO description	Potential impact	Sector
Het meten van de Nautische Diepte	IWT	Methodology to measure the nautical depth	Exploitable technical result	The development of a methodology to assess the nautical depth by measuring the rheological transition level	An accurate and cost-effective methodology to measure the nautical depth of ports and naval channels is very relevant for maritime transport and port management.	Transport
Studie voor ontwikkeling van een 3D visualisatiecomponent voor ship manoeuvring software op basis van satellietbeeldmateriaal	IWT	*N/A*				
Sensor integratie in een free fall penetrometer voor onderwaterbodem-characterisatie, SIF	IWT	GraviProbe (Free Fall Penetrometer)	*This project already evolved into a commercial product*			
Mobicloud@Sea - Draadloze digitale connectiviteit en levering van content voor mobiele toestellen in moeilijke omgevingen	IWT	*No information available => the product was registered as a trademark (https://tmdb.eu/trademark/008824575/eu)*				
Bewegingscompensatie van hydrografische apparatuur op een onbemand vaartuig	IWT	*This project already evolved into a commercial product*				
Monitoring en asset management van offshore funderingen	IWT	Monitoring and asset management of offshore foundations	Exploitable technical result	The scope of this collaborative research & development project is dealing with 'monitoring and asset management of offshore foundations' for the company Parkwind. Foundation monitoring systems have been installed on various turbines in order to get a precise view of how the structure of the foundation of an offshore foundation is changing over time, and what causes the changing behavior.	A better insight in the behavior of the foundations of offshore turbines is necessary to minimize the installations and O&M costs of future planned wind turbines.	Offshore wind energy

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Opstartfase voor infrastructuur voor conditiemonitoring en levensduurtesten, bedrijfs- en onderhoudsstrategieën	IWT	*N/A*				
Flow cytometrie als een snelle evaluatie voor waterkwaliteit (PhD)	IWT	*PhD-study. Only link to publication list of scientists. Relevant publications (e.g. dissertation) are not available in open access.*				
Verbetering van grondpenetrerende radars om bedolven onzuiverheden in kustgebieden te lokaliseren (PhD)	IWT	A simulation programme for ground-penetrating radars	Software / modelling tools	The aim of this PhD-reasearch is to improve the recognition of buried scatterers using Ground Penetrating Radar (GPR). A simulation programme was developed to give accurate results about the presence of scatters. This simulation programme will also help in the development of new GPR systems which are able to function well in difficult environments such as coasts.	The new simulation programme can be used to detect contamination on beaches such as oil lumps wich may be present in the sediment after a shipping accident.	Environmental management general Coastal management Monitoring & surveillance
Instrument voor Onderwater BodemAnalyse, IOBA	IWT	Instrument for underwater sediment analysis	*This project already evolved into a commercial product*			
Infrastructuur voor conditiemonitoring en levensduurtesten, bedrijfs- en onderhoudsstrategieën voor offshore windparken	IWT	Offshore wind monitoring and test infrastructure	Exploitable technical result	This projects aims to support and enable the development and validation of smart cost-reducing operation and maintenance solutions. For this purpose the following infrastructure is established: condition monitoring systems (CMS) for systems and components, lab infrastructure for durability testing of components and operation and maintenance strategies.	The validation of efficient operation and maintenance strategies for offshore wind farms are very important to reduce costs in the latter sector.	Offshore wind energy
Offshore WInd O&M Excellence	IWT	Data platform on behaviour of offshore wind turbines	Data	This project will realize 3 multi-usage offshore measuring systems, integrate them and gather and process the data from different sources in a data platform in an automated way. In this way the projects opens up access to real-life offshore measurements and data, develop an integrated data warehouse and support companies in the development of smart O&M solutions.	The data platform with long-term real-life offshore measurements will enable companies to develop innovative, smart and cost-reducing O&M strategies.	Offshore wind energy

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Monitoring marine populations - Antarctic fish as a baseline to develop a genetic index - AGENDEX (PhD)	IWT	Connectivity of fish populations in the Southern Ocean	Exploitable scientific result	A PhD-study about the gene flow of ice fish (*Notothenioids*) using single nucleotide polymorphisms (SNPs) as molecular markers.	Studying connectivity of fish populations is important in order to explain patterns of distribution and biodiversity and eventually to provide advice for the management and conservation of fish species.	Environmental management general Fisheries management Biodiversity Marine sciences general Marine genomics
Lange-termijn monitoring van drivers bepalend voor de areaalgrenzen van mangroven	FWO	Global monitoring network of mangrove distribution	Service / tools	The development of a global data logger network which monitors the latitudinal evolution of mangroves on all continents.	A global network monitoring the spatial evolution of mangroves is relevant for environmental managers and decision makers as these mangroves are important habitats for marine biodiversity and fulfill a crucial role in the protection of coasts against flooding.	Environmental management general Coastal management Flood risk management Marine sciences general
Microarrays: een nieuwe stap naar een snelle moleculaire karakterisatie van mariene nematoden-gemeenschappen.	FWO	*N/A*				
Een nieuwe meettechniek gekoppeld aan een nieuwe modelbenadering voor de bepaling van de effectieve valsnelheid van een flocculerend sediment in estuaria.	FWO	A new measuring technique for suspended particles	Exploitable technical result	The development of a new and reliable technique for the in situ and real-time measurement the movements of suspended particles in combination with the turbulence and size and velocity of the particles.	An accurate and robust technique to measure suspended particles relevant for environmental managers and policy makers which deal with topics as water quality, dredging and dumping, sand extraction, etc.	Environmental management general Coastal management Environmental impact assessment Coastal & ocean governance
		Integrated sediment transport model	Software / modelling tools	The development of an integrated sediment transport model covering the relation between currents on the one hand and the interaction between flocculation and turbulence on the other.	A reliable sediment transport model is highly relevant for management decisions related to activities affecting water quality.	

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De verdere ontwikkeling van operationele modale analyse technieken en structurele monitoring methodes gebruikmakende van transmissibiliteits-metingen en optische vezel sensoren	FWO	N/A				
Biogeochemische studie van anorganische en organische polluenten in sedimenten met passieve diffuse staalnamesystemen	FWO	New diffusive controlled passive sampler	Exploitable technical result	The main goal of this post-doctoral research is achieving a new understanding of biogeochemical processes of trace metals in sediments. One objective is to develop a new diffusive controlled passive sampler for determining dissolved organic pollutant concentrations in sediment porewaters. The actual passive samplers either do not use a diffusive controlled layer or use a ceramic tube both systems being not adapted for studying porewaters. Flat macroporous layers will be synthesized using either exocasting or cryogels. With the latter method, the pore size is somewhat more variable but it is a very ecological (green chemistry) process.	The newly-developed sampler may be relevant for environmental managers and scientists to achieve more accurate measurements and monitoring of contaminants in the sediment porewater.	Environmental management general Environmental impact assessment
Development of an integrated software for forecasting the impacts of accidental oil pollution	BELSPO	A new generation oil spill model	Software / modelling tools	The main objective of OSERIT is to develop a new integrated tool that is able to quickly provide relevant, scientific-based information to support the decision-making process of the best response strategy in case of marine oil pollution. This project required the development of a new generation oil spill model that is able to simulate the tridimensional drift and fate of marine oil pollution. A post-processing system was also developed to process the model results into maps and graphs of interest to the trained users. Finally, the OSERIT project required the development of a new interface that allows to quickly launch model simulations and to visualize the resulting information, including physical parameters influencing the sea state.	The OSERIT model is able to provide answers on a number of question that are highly relevant for environmental managers and decision makers in case of marine pollution: How to guide the intervention team to the spill that was observed a few hours ago and that might have drifted far away from its last known position? What is the current sea state? And for the next days? Which of the sensitive zones are directly at risk? To what level? Will the use of chemical dispersant help to reduce the damage? When should the chemical dispersants be applied?	Environmental management general Coastal management Environmental impact assessment Monitoring & surveillance Risk management Transport Modelling and prediction

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					What are the consequences if the leaking ship is pulled to the refuge place before the leak is stopped? What are the consequences if the damaged ship sinks down to the bottom? A fast, accurate and underpinned answer on these question will reduce the impact of the pollution on the marine environment. The model can also be used for the follow-up of a (presumed) illegal pollution.	
		Database with oil characteristics	Data	It is crucial to provide the right oil characteristics to the oil spill model. In order to counter the lack of information on oil characteristics in case of most marine oil pollutions, the OSERIT model was built with an oil database. This database was kept intentionally short for ease of use and includes a wide range of oil types that are likely to cross the Belgian Waters.	The database on oil characteristics which underpins the OSERIT model may also be useful for environmental managers and decision makers in other regions which deal with pollution of the same oil types.	Environmental management general Coastal management Environmental impact assessment
Monitoring Inland and Coastal waters with the APEX Sensor (MICAS)	BELSPO	Optimized water quality algorithms for the APEX sensor	Software / modelling tools	The MICAS project builds upon a new generation airborne imaging spectrometer, namely APEX (Airborne Prism Experiment) which was developed under the ESA funding scheme. The project aimed to develop high-quality products related to inland and coastal waters into the APEX processing chain. The main outcome of the MICAS project is constituted by the water quality algorithms which are optimized for the APEX sensor and integrated into the Central Data Processing Center (CDPC). In this way the algorithm can automatically produce water quality products of inland and coastal waters for the end-user community.	The automatic generation of water quality maps (e.g. chlorophyll, CDOM and suspended matter) based on satellite imagery contributes significantly to a cost-effective monitoring of seawater quality. Hence, these new algorithms are very useful for environmental managers and scientists. Furthermore, this service can be relevant for sectors such as aquaculture which depend on water quality for the production of seafood.	Aquaculture general Environmental management general Coastal management Environmental impact assessment Monitoring & surveillance Modelling and prediction
Integration of optical and acoustic remote sensing data over the backshore-foreshore-nearshore continuum, a	BELSPO	Development of a methodology to integrate optical and acoustic remote sensing data for the	Guidelines / standards	The INSHORE project was aimed at integrating optical and acoustic remote sensing data in view of studying morpho-sedimentary processes over the nearshore-shore continuum.	Integration of data over the inshore continuum is important to understand coastal erosion in a larger sediment dynamic framework. Moreover, there is wide interest from the scientific community for which detailed knowledge	Coastal management Flood risk management

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case study in Oostende (INSHORE)		nearshore-shore continuum		A methodology was developed to combine airborne hyperspectral and LiDAR data with seaborne acoustic data in order to spatially integrated maps of the sedimentology and morphology of the inshore continuum.	on the morpho-sedimentary state and dynamics (including the estimation of the coastal sediment budget) is important for the set-up of realistic impact scenarios of sea-level rise or for the prediction of the occurrence of macro benthic communities.	Monitoring & surveillance
BEL-GOYA - Dynamics of river plumes from MERIS, MODIS and GOCI ocean colour data (BEL-GOYA)	BELSPO	Review of algorithms for estimation of SPM concentration	Book / review	The general objective of the BEL-GOYA project was to develop, compare and validate algorithms for atmospheric correction and suspended particulate matter (SPM) retrieval from ocean colour satellite data of extremely turbid river plumes and estuaries. Existing methods perform well in turbid waters but are severely limited in extremely turbid waters. The particular focus was on the Gironde, Yangtze (Changjiang) and Río de la Plata river estuaries/plumes. Algorithms for estimation of SPM concentration in turbid and extremely turbid waters were reviewed and compared.	The KOs may be useful for experts involved in the environmental monitoring (e.g. water quality) - and remote sensing in particular - of large estuaries. The improved methodology allows for a more accurate detection of SPM concentrations in sediment plumes based on satellite imagery, reducing the need to go out to sea to actually perform measurements and hence, reducing the cost of the monitoring.	Environmental management general Coastal management Monitoring & surveillance Water resource management Modelling and prediction
		Improvement of algorithms for atmospheric correction	Software / modelling tools	Algorithms for atmospheric correction for extremely turbid waters were reviewed, improved where necessary and implemented for processing of imagery from MODIS, MERIS and GOCI. The NIR-FF algorithm, which assumes spatial uniformity of both aerosol type and concentration over a limited region, was found to perform best in extremely turbid waters.		
		Development of algorithms for detection of cloudy pixels in extremely turbid waters	Software / modelling tools	New algorithms have been developed and tested for the classification of clear, moderately turbid and extremely turbid water pixels and for the detection of cloudy pixels with better performance in extremely turbid waters.		
		Recommendations for optimal band sets on future ocean colour sensors for extremely turbid waters	Guidelines / standards	Recommendations are made for optimal band sets on future ocean colour sensors taking account of the needs of optimal atmospheric correction and SPM retrieval in extremely turbid waters.		
Inter-sensor Bias Estimation in Sea	BELSPO	A methodology to correct satellite	Software / modelling tools	Long-term data sets of homogeneous quality are needed for climate studies. Therefore, it is necessary to develop or improve techniques to homogenise	The developed methodology will allow to construct homogeneous SST data sets from various sensors resulting in more	Climate Change General

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Surface Temperature (BESST)		inter-sensor differences		data coming from different satellites, as biases exist between them due to their technical characteristics and the changing physical properties of the measured environments. The development of a methodology to correct satellite inter-sensor differences, and that can be applied to any variable where this problematic appears. The methodology is tested for sea surface temperature (SST) measurements where differences in SST are analysed by implementing DINEOF (Data INterpolating Empirical Orthogonal Functions).	accurate estimates of long term SST trends. Hence, the development will improve the quality of climate research (incl. predictions, scenarios, etc.).	Environmental Management General Monitoring & Surveillance Marine Sciences Oceanography Modelling & Prediction
Remote sensing of turbid waters in the Short Wave Infrared (SWIR: 1-3µm) (SEASWIR)	BELSPO	Model estimating marine reflectance	Software / modelling tools	SEASWIR aimed at developing an analysis methodology for optical remote sensing in extremely turbid waters (TSM > 100 g/m³) using short wave infrared. A model is developed which estimates marine reflectance as function of TSM or turbidity and wavelength and other parameters.	The SEASWIR projects develops several components which contribute to an analysis methodology for optical remote sensing in extremely turbid waters. Some of these components may be relevant as stand-alone outputs for experts in remote sensing. The analysis methodology will contribute to a cost-effective monitoring of sediment plumes in aquatic environments. As such, this methodology is very relevant for environmental managers and scientists who deal with environmental impacts of important river estuaries/plumes and in the monitoring of inland waters.	Environmental management general Coastal management Environmental impact assessment Monitoring & Surveillance Modelling & Prediction
		Algorithm to estimate TSM and turbidity from marine reflectance	Software / modelling tools	In the project an algorithm is developed to invert the model to estimate TSM and turbidity from marine reflectance in extremely turbid waters.		
		Evaluation of effects misapplication of the SWIR black pixel assumption	Exploitable scientific result	SEASWIR conducted an evaluation of the effects of misapplication of the SWIR black pixel assumption in atmospheric correction and quantification of errors in the retrieval of the water-leaving radiance.		
		Theoretical base for the analysis of salinity variability using SWIR	Exploitable scientific result	SEASWIR established the theoretical base to evaluate whether the salinity-related variability of pure water refractive index and hence Fresnel reflectance coefficient in the SWIR can be detected by a (future) radiometer by use of sunlight.		
Preparation for Geostationary Ocean Colour (GEOCOLOUR)	BELSPO	Development of a new approach for exploiting spatio-temporal coherency of data from geostationary sensors	Software / modelling tools	The GEOCOLOUR project has the general objective of improving the quality and quantity of marine optical products from the existing SEVIRI geostationary sensor and to prepare the design of the next generation of geostationary ocean colour sensors. Specific obstacles that are tackled by the project are the cloudiness/sunlight and processes with a variability at time scales shorter than the daily sampling frequency of polar-orbiters.	The new approach improves the quality and quantity of marine optical products from the existing SEVIRI geostationary sensor. While the methodology is tested in the North Sea, it can be generalised to allow automated processing of other subregions of the earth. Hence, high-quality data about water quality (e.g. suspended matter, chlorophyll a, SST,	Aquaculture General Environmental Management General Coastal Management

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				A new approach for exploiting spatio-temporal coherency of data from geostationary sensors is developed. This includes an improved processing methodology for marine optical products in order to reduce uncertainties in the atmospheric correction and in the Total Suspended Material algorithm. The approach is tested on the multi-year archive of the North Sea and the derived products are quality controlled by matchup validation against in situ measurements and by inter-sensor comparison. Finally, a geostatistical analysis will be performed of the resulting dataset.	etc.) becomes available for a large(r) geographic area, in a cost-effective way. This is not only useful for environmental managers and scientists but also for sectors such as aquaculture which rely on the water quality for the production of seafood.	Monitoring & Surveillance Water Resource Management Modelling & Prediction
High resolution merged satellite Sea surface temperature fields (HISEA)	BELSPO	Development of a technology that allows to merge different data sets at very different sampling intervals (in space and time)	Software / modelling tools	Several satellites measure Sea Surface Temperature (SST), each of these with different technical specificities and error sources. Together with in situ data, they form a highly complementary data set. The creation of merged SST products, integrating the strengths of each of its components and minimizing their weaknesses, is however not an easy task, but it is certainly a desirable goal that has generated a large amount of research over the last years. DINEOF (Data Interpolating Empirical Orthogonal Functions) is a technique to infer missing data is satellite data sets. The HISEA-project developed an extension to DINEOF to merge several datasets. This enables to create integrated products at the highest sampling frequency and with the highest quality possible.	The development of this new technique will allow to combine datasets of SST and create integrated products at the highest sampling frequency and with the highest quality possible. The technique was also tested on other parameters such as total suspended matter. Hence, the improvements that were made in the DINEOF-technique will allow scientists and environmental managers to create combined datasets of a higher quality which may also be useful for sectors such as aquaculture.	Climate Change General Environmental Management General Monitoring & Surveillance Oceanography Modelling & Prediction
Jellyfish forecasting service based on Earth Observation (JELLYFOR)	BELSPO	Software for a jellyfish forecasting service	Software / modelling tools	The JELLYFOR project aimed to develop a new service to forecast the jellyfish occurrence for a given salinity, temperature and chlorophyll-a conditions. This service integrates optical satellite data, forecasting algorithms, and in situ measurements on a GIS prototype platform. Model-based software for a jellyfish forecasting service has been developed and tested for the Catalan and Irish regions with respectively Earth Observation (EO) input and in situ data input. The supporting EO software has been automated and	The forecasting service is very relevant and useful for marine tourism and recreation and may reduce the risk of injuries of bathers and recreationists due to harmful jellyfish. An accurate prediction of jellyfish occurrence allows the competent authorities to take the necessary measures and inform civil society.	Risk Management Modelling & Prediction Consumer Health & Welfare Coastal Management

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				generalised for application to any geographical region.		
A network for marine optics measurements in turbid waters (TURBINET)	BELSPO	Generalized Turbidity Algorithm	Software / modelling tools	TURBINET is a network to establish long-term collaboration and data-sharing by establishing harmonized measurement protocols and data quality for ocean colour satellite data validation activities. The project developed a single algorithm to retrieve turbidity in coastal and estuarine waters from ocean colour remote sensing.	Harmonized measurement protocols for ocean colour satellite data will facilitate collaboration and data-sharing between partners from different regions. Hence, a generalized methodology will lead to comparable datasets which are easily exchangeable.	Environmental Management General Monitoring & Surveillance Marine Sciences General
		Protocols for measuring turbidity from satellite sensors	RTD protocol / technical manual	The project defined agreed protocols for in situ measurements for two sensors (HACH 2001P/Q and OBS500) in order to achieve long-term sustainability of these activities.		
PAMIR - A Portal to Atmospheric and Marine Information Resources	BELSPO	expected result: PAMIR validation protocol	RTD protocol / technical manual	The purpose of the PAMIR project is to explore common and specific aspects of atmospheric and oceanographic data validation and documentation in order to generate harmonised practice guidelines and tools in compliance with international standards. A validation protocol will be developed in accordance with the Quality Assurance Framework for Earth Observation (QA4EO) principles and a metadata scheme compatible with the INSPIRE requirements. More specifically for the marine environment, the project will improve its capacity to comply with the reporting obligations set by the Marine Strategy Framework Directive.	The validation protocol that will be developed in PAMIR may be relevant for other environmental data managers and scientists to make their datasets compliant with international standards. Hence, this will in turn significantly improve the usefulness and accessibility of these datasets.	Environmental Management General Oceanography Climate Change General Marine Sciences General
		expected result: PAMIR portal (a gateway to atmospheric and oceanographic data collections of the Belgian federal portfolio)	data	The PAMIR portal is intended to become a gateway to atmospheric and oceanographic data collections of the Belgian federal portfolio. The portal is currently under development and, at this stage, only offers some static information.	The integration of different types of datasets (atmospheric and oceanographic) through one portal will significantly improve the ease of use of scientists, environmental managers (informed decision making) and even stakeholders from the offshore industry (e.g. offshore wind energy) which need data on the marine environment.	Environmental Management General Oceanography Climate Change General Marine Sciences General

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						Monitoring & Surveillance Modelling & Prediction Ocean Energy General
INDI67 - Developments of methods to improve the monitoring of MSFD indicators 6 and 7	BELSPO	*The project is ongoing. No website with interim results.*				
NEWSTHEPS - New Sampling Tools for Heritage & Emerging Pollutants to facilitate GES assessment in the Marine Environment	BELSPO	Expected result: novel procedures for comprehensive environmental monitoring and risk assessment of marine contaminants	Guidelines / standards	NewSTHEPS aims to develop innovative approaches and novel practical techniques that address the current fundamental scientific and methodological issues related to the implementation of Good Environmental Status (GES) for Descriptor 8 of the Marine Strategy Framework Directive that aims to ensure that the levels of contaminants in the marine environment do not give rise to pollution effects. Expected result: develop and validate, possibly for the first time, the combined and integrated use of passive samplers, innovative mass spectrometric based instrumental analysis and ecotoxicological studies to assess the environmental status of the marine environment. This integrated approach will lead to the development of novel procedures for comprehensive environmental monitoring and risk assessment of a broad set of priority and emerging marine contaminants	The development of improved, cost-effective monitoring of contaminants in the marine environment has many applications. There is a direct link with the MSFD (descriptor 8), but a robust and reliable methodology may as well be relevant for seafood-sectors and tourism which rely on a healthy marine ecosystem.	Environmental Management General Coastal Management Environmental Impact Assessment Monitoring & Surveillance Water Resource Management Coastal & Ocean Governance Quality/Health & Welfare Consumer Health & Welfare
		Expected result: An integrated model to quantify the environmental status of the Belgian coastal zone	Software / modelling tools	Expected result: develop and validate an integrated model to quantify the environmental status of the Belgian coastal zone by predicting accumulation, trophic transfer and effects of chemicals in its local ecosystem	An integrated model to quantify the environmental status of the Belgian coastal zone will be particularly interesting as a tool for environmental managers and policy makers which monitor the marine environment. Furthermore, this model may help with	Environmental Management General Coastal Management Environmental Impact Assessment

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					raising awareness about marine pollution to civil society.	Monitoring & Surveillance Coastal & Ocean Governance Modelling & Prediction Consumer Health & Welfare
		Expected result: Database on contaminants	Data	Expected result: Databases, accessible both on national and international level, containing levels of priority as well as emerging pollutants.	This database will contribute to exchange of knowledge and expertise regarding emerging contaminants in amongst experts on a national and international level. Hence, it will deliver direct input for the knowledge base which underpins descriptor 8 of the MSFD.	Environmental Management General Coastal Management Environmental Impact Assessment Monitoring & Surveillance Coastal & Ocean Governance Consumer Health & Welfare

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