

Improving the capacity in hydrography

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Capacity building (CB) is a highly important part of the strategy of the International Hydrographic Organization (IHO). It provides an extremely valuable opportunity for Coastal States to get support for their development in hydrography and improves the cooperation with other countries. It makes use of the experiences gained to a wider community. It is a vital component of the efforts of intergovernmental technical organisations to support the development goals of the United Nations (UN). The IHO is committed to support its Member States and to a certain extent also other Coastal States, to improve their capacity in hydrography. As the resources are limited, the IHO CB is giving priority to those States that are not capable to fulfil this task completely on their own. This paper describes the way CB is done at the IHO, what challenges it is facing and it gives examples especially from the French national approach.

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renforcement des capacités | Shom | Catégorie B | construction de navires | financement | e-learning
Kapazitätsaufbau | Shom | Kategorie B | Schiffbau | Finanzierung | E-Learning

Le renforcement des capacités (CB) est une partie très importante de la stratégie de l'Organisation hydrographique internationale (OHI). Il offre aux États côtiers une occasion extrêmement précieuse d'obtenir un soutien pour leur développement en hydrographie et améliore la coopération avec d'autres pays. Il permet de faire profiter une communauté plus large de l'expérience acquise. Il s'agit d'une composante essentielle des efforts des organisations techniques intergouvernementales pour soutenir les objectifs de développement des Nations Unies (ONU). L'OHI s'engage à soutenir ses États membres et, dans une certaine mesure, d'autres États côtiers, afin d'améliorer leurs capacités en matière d'hydrographie. Comme les ressources sont limitées, le CB de l'OHI donne la priorité aux États qui ne sont pas capables de remplir cette tâche complètement par eux-mêmes. Ce document décrit la manière dont le CB est réalisé à l'OHI, les défis auxquels il est confronté et donne des exemples, notamment de l'approche nationale française.

Der Kapazitätsaufbau (Capacity Building) ist ein äußerst wichtiger Teil der Strategie der Internationalen Hydrographischen Organisation (IHO). Er bietet den Küstenstaaten eine extrem wertvolle Möglichkeit, Unterstützung für ihre Entwicklung in der Hydrographie zu erhalten und die Zusammenarbeit mit anderen Ländern zu verbessern. Er macht die gewonnenen Erfahrungen einem größeren Kreis zugänglich. Er ist ein wesentlicher Bestandteil der Bemühungen zwischenstaatlicher technischer Organisationen, die Entwicklungsziele der Vereinten Nationen (UN) zu unterstützen. Die IHO ist bestrebt, ihre Mitgliedstaaten und in gewissem Umfang auch andere Küstenstaaten bei der Verbesserung ihrer Kapazitäten im Bereich der Hydrographie zu unterstützen. Da die Ressourcen begrenzt sind, bevorzugt der Kapazitätsaufbau der IHO diejenigen Staaten, die nicht in der Lage sind, diese Aufgabe vollständig selbst zu erfüllen. Dieser Artikel beschreibt, wie der Kapazitätsaufbau bei der IHO durchgeführt wird, welche Herausforderungen es zu bewältigen gilt, und er nennt Beispiele, insbesondere aus dem französischen Ansatz.

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1 Capacity building organisation among IHO

1.1 Strategy

The vision of the IHO CB as stated in its policy paper is to provide strategic guidance for IHO capacity building to ensure the optimum contribution to safety of life at sea, to the protection of the environment and to national economic development.

In the IHO, capacity building is defined as the process by which the organisation assesses the status of current arrangements and assists States to achieve sustainable development and improvement in their ability to meet hydrographic, cartographic and maritime safety obligations with particular reference to recommendations in UNCLOS, SOLAS and other international instruments. The scope encompasses all hydrographic needs as it



Fig. 1: Technical visit in Congo funded by IHO and carried out by Shom in November 2021

underpins every other activity associated with the sea, including safety of navigation, protection of the marine environment, national infrastructure development, coastal zone management, marine exploration, marine resource exploitation (minerals, fishing, etc.), maritime boundary delimitation, maritime defence and security, and coastal disaster management.

1.2 Organisation

The IHO established a Capacity Building Sub-Committee (CBSC), the current Chair is Evert Flier from Norway. The tasks are in close cooperation with the IHO Secretariat to:

- continuously assess the hydrographic surveying, nautical charting and hydrographic information status in nations and regions where hydrography is developing;
- establish and maintain close relationships with national and international organisations, which may provide funding or other support;
- operate the Capacity Building Fund;
- develop, manage and coordinate the assessment and provision of CB in close cooperation with the Regional Hydrographic Commissions.

The CB at the IHO is relying on the contributions from Member States and a rather small fund from the IHO budget. Major contributions are being provided by the Republic of Korea and the Nippon Foundation with funds earmarked for certain projects. Other countries, namely France, provide direct support like trainings and technical visits (Fig. 1). The support goes far beyond the funded projects. This can as well be the provision of equipment, facilities, trainers or direct support to certain participants. Allocated funds sometimes exceed 1 Million €, but funding technical equipment is not included. The projects are mainly:

- raising awareness in countries, where hydrography is not sufficiently implemented, especially through high level visits;
- technical visits to assess the status and needs and to propose recommendations at technical but also institutional levels;
- workshops and seminars;

- onboard and on-the-job training;
- education like Category A and B courses.

Funding is provided partially or fully for travel expenses, per diems, trainers and/or training facilities.

The proposals as well as the development and execution of projects is mainly based on the Regional Hydrographic Commissions (RHC). Each RHC installed a Capacity Building Coordinator, which are members of the CBSC.

One excellent example for the success of the CB is the Suriname. This rather small country has been supported some years ago to improve its capacity in hydrography and is now in a position to support other countries in the region.

Proposals for support and the inclusion into the CB programme have to be forwarded to the CBSC by IHO Member States usually via an RHC.

Two important current developments should be mentioned especially. Both are, to a large extent by Republic of Korea. One is the e-learning platform and the other one is the Training-for-Trainers (TFT) project. The latter one is at this stage limited to the East Asia Hydrographic Commission (EAHC) and enables States to build up their own training capabilities by multiplying the capacity and bringing it into the countries. This also reduces travel expenses. The e-learning platform will make better use of online trainings and is seeking for more in-kind contributions of training material.

The IHO CB is not working in isolation, it cooperates with other CB initiatives, namely IMO, IOC, WMO, but also liaises with the RENCs.

A potential conflict has always been the prioritisation between projects that are more basic (and thus important for many developing States) and the more fashionable ones like S-100 development or MSDI. The CB Strategy and the related procedures forms the basis for the decisions. Neediness, importance, contributions and the potential for success.

Another good example is the project »Empowering Women in Hydrography«. Women are still significantly underrepresented in leadership positions in hydrography. To try and change this, the

IHO has launched a new project to »Empower Women in Hydrography« with the goal of raising awareness about career opportunities in hydrography and to increase the number of women in leadership positions.

2 An example of a national approach: capacity building activities of the French hydrographic and oceanographic service (Shom) in third countries

Although capacity building knows an important dynamic at the multinational level in bodies such as the IHO with the activities mentioned above, most of the hydrographic, oceanographic and cartographic capacity building activities are carried out in a bilateral framework. In that respect, the hydrographic and oceanographic service of France develops actions for the benefit of other States which enable them to acquire or strengthen the necessary skills and tools to ensure their sovereign mission of safety of navigation in their waters, but also to broaden their scope of work/field of activity to associated areas.

2.1 Setting up partnerships in the SOLAS Convention framework

By ratifying the International Convention on the Safety of Life at Sea (SOLAS), a country undertakes to arrange for the collection and compilation of hydrographic data and the publication, dissemination and keeping up to date of all nautical information necessary for safe navigation [in its waters] (SOLAS Convention, Chapter V – Regulation 9). The same regulation offers the possibility for States without the capacity to delegate this role to another State to do so. This delegation of authority, commonly named »Primary Chart Authority« (PCA), is also framed in the IHO resolutions. It re-

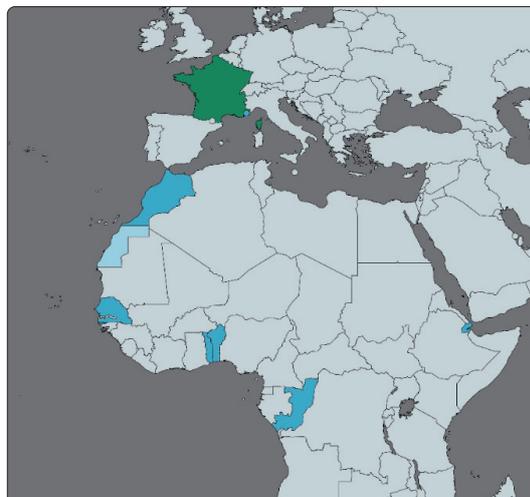


Fig. 2: Coastal States which have signed an Administrative Arrangement with France in the frame of SOLAS Convention

quires a good coordination between the Coastal State and its PCA to generate efficient and relevant nautical information feedback and to ensure that nautical documents, on which the maritime traffic of the coastal country depends, are properly updated.

In the case of France, this assumption of responsibility as PCA is formalised and framed with the Coastal State through the signature of an Administrative Arrangement for cooperation in hydrography and marine cartography signed at ministerial level (Fig. 2).

These Administrative Arrangements, in addition to enabling Coastal States to meet their SOLAS commitments, also define a support from the PCA to progressively develop their capacities in the dedicated fields. The ultimate aim is for Coastal States to have developed their hydrographic services, to be able to identify navigational needs and to specify and carry out hydrographic surveys, and to produce, disseminate and maintain nautical products. This process can last several years and is to be realised step by step by adapting the training to the specific situation of each country.

Following a fruitful partnership since the signing of such an Arrangement between France and Morocco in 2008 (cooperation having started long before the Arrangement), the Moroccan Hydrographic Service (DHOC) is now in a position to carry out its own surveys and to produce the nautical charts and structures in its waters. Morocco's cartographic autonomy is underway with a transitional period for the latter to ensure cartography on all its coasts.

2.2 Visits by experts from Shom

Within the framework of bilateral relations with Coastal States, it is possible for Shom to set up cross-expert visits. Those allow both the visit of a local expert delegation to France, in order to discover the associated French theme and procedures, and the visit of Shom experts to the Coastal States to present their methods and tools. This expertise allows the identification of needs in terms of training and resources as well as the sharing of knowledge and experience. Bilateral action plans can thus be set up in targeted areas according to the country's needs.

Repeating these visits makes it possible to evaluate the effectiveness of the actions carried out and to update the action plan according to the progress made. The reliability and relevance of the analysis is guaranteed by the high level of qualification of the experts, coming from the Shom's production or research teams.

2.3 Training of foreign students at Shom

Because of its high-stake missions, Shom's responsibility can be engaged. As a consequence, it is

imperative to master the entire data production chain; this cannot be done without integrating the very specific skills and training of the personnel. Since hydrography for nautical safety purposes and marine cartography at the technician level, are not taught in any school in France, Shom has created its own school with its own training resources in its fields of competence (Fig. 3).

Shom school provides a one-year programme in hydrography and a one-year programme in marine cartography, both of them recognised at Category B level by the International Hydrographic Organization (IHO).

These two courses are primarily intended to train the future hydrographic technicians and cartographers of the Shom.

But these courses are also open to external students. A partnership was concluded in 2017 with the UBO to allow civilian students to follow the hydrography programme. This opening allows us to meet a growing need for qualified manpower in the civil hydrography industry.

Moreover, international students, with required scientific level (usually scientific baccalaureate + 2 years) are welcomed to apply to those Shom certified curriculums. Usually one or two foreign students on average are admitted to the Shom school either as part of the French cooperation programme or through bilateral partnerships with foreign hydrographic services. These foreign trainees are most often military officers or naval officers from very different countries: Morocco, Lebanon, Indonesia, Ivory Coast, etc.

After completion of their training, Shom delivers a degree in hydrography Category B and a degree in marine cartography Category B, according to the training followed.

At the end of the course in hydrography, the military students are usually assigned on the hydrographic fleet of their country. The best civilian students can enter a Master's degree or even one of the Category A programme in hydrography at ENSTA Bretagne.

At the end of the course in marine cartography, the students are assigned to the cartography department of the hydrographic service in their country.

In addition to its long courses approved by the IHO, the Shom's catalogue of continuing education courses also offers a wide range of short courses to improve the skills of personnel in particular fields of hydrography, marine cartography, oceanography or marine geophysics. Any students, including foreign ones, may apply for these courses.

Finally, Shom offers tailor-made courses. These courses are particularly aimed at foreign trainees, who need in-depth training or specialisation in a specific field. For example, two or three times since 2018 to the benefit of Morocco or Tunisia, Shom has set up a training course on the marine chart data validation. These are three-week immersion courses in the »marine cartography« department to learn the validation procedures of the Shom's cartographic controllers. These internships can be adapted and targeted to specific aspects according to the request.

L'océan en référence

TRAINING COURSES PROVIDED BY SHOM SCHOOL

BS/L3+ HYDRO*

Average number of students → 2 to 8 petty officers/ 2 foreign students/ 10 students UBO

Duration → 14 months

Admission → based on application file

Curriculum → manoeuvring and navigation Training
specific course on hydrography and oceanography
on board end-study project

C SYGRES-HOM

Average number of students → 2 to 5 hydrographers petty officers

Duration → 9 months

Admission → based on application file

Curriculum → information technology theoretical and practical training (application to hydrography IT)
Practical internships in SHOM IT department and survey unit (GHOA)

C SUP HYDRO***

Average number of students → 2 to 5 hydrographers petty officers

Duration → 4 months

Admission → based on application file

Curriculum → advanced technical training on hydrography
team management training

NAUTICAL CARTOGRAPHER TRAINING COURSE*

Average number of students → 2 to 8 trainees

Duration → 9 months

Admission → based on diplomas or competitive exam

Curriculum → general training on hydrography and geosciences
specific training on nautical cartography
end-study technical project

*Information carried out in partnership with the IHO. Its validation allows you to obtain a bachelor's degree.

**Recognized training course of category B level by IHO-ING-ICA international board.

***Recognized training course of category A level by IHO-ING-ICA international board. Engineering degree accredited by CTI and labeled EUR-ACE (accreditation of engineering courses in Europe)

****Title of "Hydrographic Superior" recognized in the BOUAF and certified at level 3 (bachelor's degree)

SHOM school support to

HYDROGRAPHIC ENGINEER**

Average number of students → 36 months (+12 months for French military students)

Duration → based on diplomas or competitive exam

Admission → see: www.ensta-bretagne.fr

Curriculum

www.shom.fr

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Fig. 3: Training courses provided by Shom school

Shom is also called upon to provide advice and expertise to foreign countries for the choice of hydro-oceanographic measurement equipment to be integrated on board a new hydrographic vessel. In this context, the Shom school is involved in training scientific and technical teams in the integration and use of measurement equipment, so that the hydrographic service of the foreign navy can carry out surveys and products in accordance with the standards of the IHO.

Shom school pedagogical team consists of three permanent teachers, one Category A hydrographic engineer and Category B hydrographic surveyors. This staff is complemented by university teachers and around 80 temporary Shom staff who deliver courses in their field of expertise. A noticeable amount of the training is about practical skills and requires students to achieve some experiments and surveys. For that purpose, Shom school uses one of the Shom hydrographic launch, equipped with a multibeam echo sounder. French military students are also trained (during their complementary training) to operate French navy compact military hydrographic system (SDHM) used for rapid hydrographic assessment before beaching operations.

2.4 Support to project management for the construction of hydro-oceanographic vessels

Shom has recognised expertise in the construction of hydro-oceanographic vessels (from eight-metre launches to 100-metre ships). It has technical experts in the field of acoustic equipment (e.g. multibeam echo sounders, side-scan sonars, current profilers), oceanography (e.g. CTD, sampling), sedimentology (e.g. sediment sounders, corers), geosciences (e.g. magnetometers, gravimeters), positioning and attitude (e.g. GNSS, reference stations, inertial units, USBL systems) who are in charge of the entire process, from the expression of need to the implementation of systems. The multitude of systems that Shom implements and its active and permanent

work of technological watch make it a particularly advanced player in the field of hydro-oceanographic equipment.

Shom has a deep expertise in capacity building by assisting shipyards to the construction of hydrographic and oceanographic vessels:

- studies, in order to define, on the basis of an expression of need, the complete specifications in terms of hydro-oceanographic equipment (including IT), but also in terms of fitting out the premises and scientific areas of a hydro-oceanographic vessel. Shom provides intellectual services such as definition of the metrology survey for proper integration and control of the systems, specification of spare parts batches adapted to the ship's missions, the interface file, the acceptance booklet and the ship's log (in its field of competence);
- equipment acceptance and integration: supervision of equipment integration (e.g. mechanical, interfacing, metrology), factory, dockside and sea acceptance;
- training and assistance: training (both on land and at sea) of the crew who will be implementing the equipment, but also of personnel ensuring the maintenance of the systems, transfer of skills, handling of warranty calls after delivery of the vessel to the end customer. Shom's school in Brest (France) is also able to deliver dedicated training sessions in English for specific projects. This training can be focused on hydrography, oceanography, cartography or any other field related to Shom's activities (Fig. 4).

After delivering of the vessel Shom can participate in the crew training in the country and assist the client with a technical assistance in hydrography and oceanography.

This work has been done in the past years for Indonesia (Fig. 5), Morocco, Algeria and Nigeria (Fig. 6) with different French shipyards.

Since 2018 Shom is working with French shipyard OCEA on OSV190 *NNS Lana* for Nigeria (Fig. 6): after the studies, construction took place in Les Sables d'Olonne with a dedicated



Fig. 4: Training of Nigerian navy hydrographers at Shom (Brest, France)



Fig. 5: *Rigel*, hydrographic and oceanographic vessel (Indonesia)



Fig. 6: NNS Lana before launching in Les Sables d'Olonne



Fig. 7: NNS Lana in Lagos (Nigeria)

full-time engineer. In 2021, a Nigerian team was trained both theoretically and practically during four weeks in Shom's school in Brest (France). They learned about the equipment of their new ship *NNS Lana* and participated in several practical sessions for using GNSS equipment and other related tools. Training also took place on-board the ship in France and on site in Nigeria (Fig. 7). The technical assistance phase in Lagos started end 2021 and will continue until 2023, with the support of a Category A hydrographic engineer full time for more than a year. During this technical assistance period Shom will help the Nigerian Navy to solve issues that can happen on the hydrographic and oceanographic vessel, assist in the configuration and use of the equipment and provide advice on how to make different types of survey. Once the surveys are made, guidance is provided on data processing, data validation and how to elaborate survey reports complying with IHO standards.

This partnership is meant to help the Nigerian navy hydrographic office to train its personnel and ensure that they are able to complete hydrographic and oceanographic surveys up to the IHO standards. The main purpose for *NNS Lana* at this time is to survey the approaches to Lagos in order for Nigerian authorities to make their own nautical chart of this area. Many uncharted wrecks have been already discovered proving that this work is critical for safety of navigation in these waters. For shallow area the *NNS Lana* has its own hydrographic launch, also equipped with multibeam echo sounder, allowing the Nigerian navy to survey in places where the main vessel can't.

In addition, advice and expertise have been provided in the framework of exchanges with prospects in other countries. These partnerships contribute to develop Shom's expertise in hydrographic and oceanographic capacity building as well as they are also helping to develop the hydrographic cooperation and technical exchanges between the countries involved.

3 Challenges related to capacity building

The ever-increasing need for building capacity in Coastal States, as well as technological and societal developments (including the recent Covid-19 pandemic), pose challenges to the various contributors in order to carry out this essential process.

3.1 Search for funding

The IHO CB is trying to retrieve additional funds from donor organisations, but this is depending on decent and usually more complex proposals. The funds can be used for consulting expenses in this regard, but success has been depending so far on the lead by a Member State.

3.2 Adapting to e-learning and innovative tools

Distance learning, which can be accessed from anywhere provided there is an internet connection, is flexible in time and adaptable to the needs of students, has developed in recent years and underwent unprecedented expansion in response to the Covid-19 pandemic. This practice has become as much a part of modern society as teleworking, and needs to be further developed in the field of hydrography and related sciences in order to increase the efficiency of capacity building.

At the international level, IHO is developing e-learning opportunities. Several IHO Members raised the need for e-learning to support IHO CB initiative at the 1st Session of the IHO Assembly in 2017. Following that proposal (Pro 3.3 of A-2) the CBSC established the e-learning project team (PT) to start preparing for the establishment of the IHO e-learning centre by the Republic of Korea. This centre is now close to be operational and will host the first Shom MOOC on Maritime Safety Information from a range of courses and teaching materials in different languages that are accessible to a wide range of people. Shom school is an active member of the e-learning project team to move forward this IHO e-learning centre.

E-learning is also developed at national levels. For instance, Shom school has undertaken to develop distance learning in order to facilitate access to its training courses for certain personnel, such as on-board hydrographers, who are not always available for face-to-face training, but also for foreign trainees who are far from the training site. To achieve this aim, Shom school has started a digital transformation of its training system, in order to offer hybrid training programmes, with educational qualities equivalent to those of face-to-face training, or even improved thanks to the multiple possibilities offered by digital technologies of teaching. To this end, Shom is recruiting an educational engineer and is going to equip itself with a Learning Management System (LMS) that will improve access to the training offer by making the courses permanently accessible, with or without an internet connection, without waiting for the organisation of sessions that are necessarily limited in volume (number of participants) and frequency. Synergies will be sought with its partners, to share resources on common platforms or to develop resources in common, notably the IHO e-learning platform.

4 Conclusion

In closing, capacity building is multi-faceted: it embraces cooperative activities at different scales with the ultimate goal of ensuring safe navigation around the world by strengthening each of its actors.

This policy must be based on three pillars in order to be effective and have a lasting effect. Firstly, high skills are required which implies well trained and qualified personnel. Secondly, high standard material is necessary to enable staff to put in prac-

tice their practical knowledge. Last but not least, the structure, whether decision-making or functional, must not be forgotten. Coastal States must have governance bodies that bring together the various maritime safety stakeholders to identify and prioritise needs, to give a national dynamic ranging from the acquisition of data at sea to the dissemination of nautical products and their maintenance and to the management of maritime safety information. Nonetheless, there is obviously a need for a functional structure like a national hydrographic service capable of implementing these directives in the waters under the responsibility of the Coastal State.

This policy requires long-term efforts but also substantial funding without which no action can be taken. It is therefore necessary to look for funding outside the IHO, which requires networking and a good knowledge of the various regional players and issues.

The duration of capacity building also makes it sensitive to changes in society, especially those with the greatest impact such as reducing the carbon footprint and new distance learning methods. It is therefore necessary to continuously adapt and modern practices in terms of training.

For many Coastal States, capacity building in hydrography, oceanography and marine cartography often represents the first link in a chain enabling them to ensure the safety of navigation in their waters, thus reinforcing and increasing maritime traffic in their ports and consequently their economy. But much more than that, in the longer term, this chain also enables the development of a blue economy in a sustainable manner and helps States to adapt to coastal evolutions due to natural phenomena and also to climate change. //