



BREST : A EUROPEAN AND INTERNATIONAL SCALE HUB

In marine science and technology

Summary | May 2011

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SUMMARY	24

The Shanghai ranking system, devised by Shanghai Jiao-Tong University suggests ranking the main universities in the world on the basis of six objective criteria (number of Nobel prizes and Fields medals won by alumni, number of Nobel prizes and Fields medals won by researchers, number of highly-cited researchers in their subject categories, articles published in the journals Nature and Science between 2000 and 2004, the Science Citation Index and the Arts & Humanities Citation Index, and the per capita academic performance of an institution.) This approach has the advantage of offering an international ranking system.

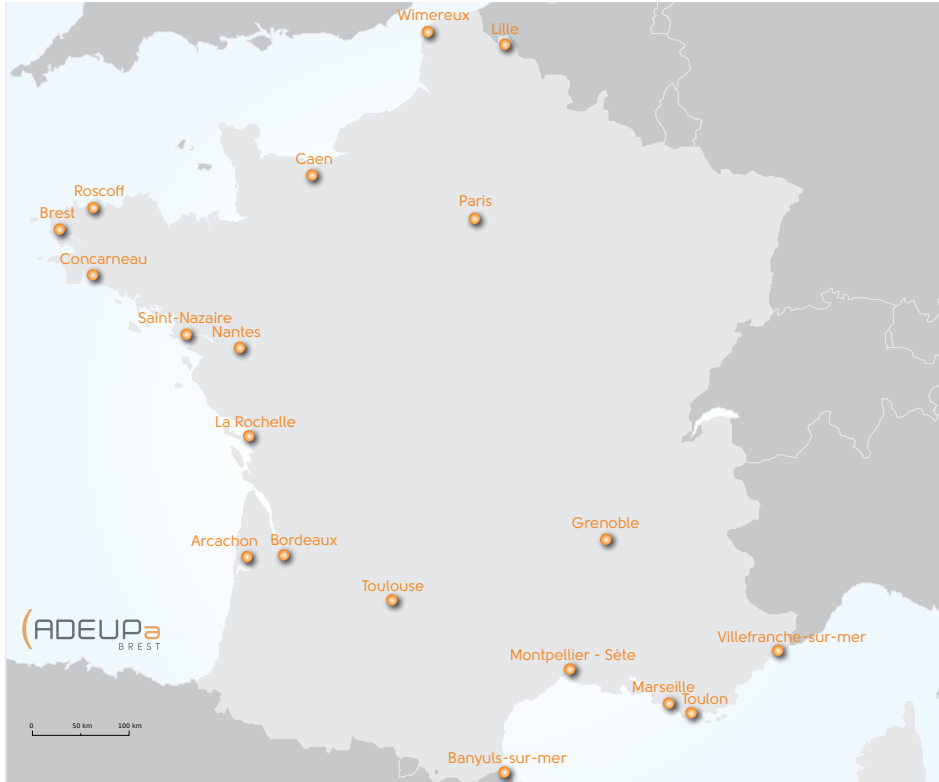
Yet this ranking system cannot be used to assess specific fields such as marine science and technology, which encompasses several categories, and is therefore far less likely to fit into a ranking system on the basis of Shanghai ranking system markers.

For the purpose of this study, a steering committee was created on the scale of the town of Brest. It is made up of representatives from the University of Western Brittany and the European Institute for Marine Studies (UBO-IUEM), the Scientific Interest Group GIS Europe Mer, the Mer Bretagne business cluster, Brittany's National College of Advanced Techniques (ENSTA), the Naval hydrography and oceanography department (SHOM), the Chamber of Commerce and Industry, Technopôle Brest Iroise, the Brest Métropole Océane (local authority) and the Maritime and Fluvial Technical Study Centre (CETMEF), its role being to validate and direct methodological choices made throughout the study. It also ensured the coherence of results.

The steering committee has selected a number of towns in which marine science and technology occupies an important position both in terms of training-research and related economic activity sectors. The starting point was that of the geographical area: the urban area. As far as Brest is concerned, this area has been extended to Western Brittany¹ which is a veritable territorial system that revolves around such metropolitan functions as higher education, research and structuring fields such as the maritime domain.

1. See : Atlas of Western Brittany metropolitan functions, ADEUPa, June 2010

French towns concerned by the study



European towns concerned by the study



International towns concerned by the study





Photograph : Brest harbour - T. JOYEUX

CONTEXT AND OBJECTIVES

The national context in 2010 in which files were drawn up for the invitations for "Investments for the future" projects highlighted the dire need for us to be able to measure ourselves and rank our skills compared to other key sites in certain areas of excellence, and in Brest's case: the sea.

The objective of the study is, on the one hand, to study Brest's position compared to other key sites in the maritime domain at national, European and international level; and on the other hand to define Brest's areas of excellence. For each one of the chosen sites we identified the training-research actors (universities, research institutes and centres). A series of markers was then identically and systematically collected for each site in view of ranking Brest compared to the other sites concerned by the study.

Brest's position with regard to marine science and technology and its limits

Concerning the maritime domain, marine science and technology is usually designated as encompassing scientific activities as well as those related to the technological applications of research, particularly those carried out for industrial purposes.

Yet the sectors of excellence in research and economic activity sectors differ depending on where they are being studied, and it is therefore impossible to come up with a single definition to convey what is covered by marine science and technology. It is everything at once at varying degrees, depending on the site: oceanography, marine biology, space marine observation, remote sensing, shipbuilding and ship repair and related research (ship architecture and hydrodynamics), renewable marine energies, etc.

Concerning the economic aspect, the data collected are patchy and incomplete which means it is impossible to compare the towns concerned by the study.

As far as the towns in this study are concerned, it transpires that the ranking is sound at national level, admissible at European level but incomplete at international level. With regard to the latter, the number of sites concerned by the study is insufficiently representative to be able to position Brest with accuracy; yet some elements of comparison do exist.

1. The human and scientific means of training-research

Choice of markers and usual precautions

The markers used within are the number of researchers and research professors. They have been recorded for each actor involved in marine science and technology training-research, then aggregated per town.

Data was collected from university and research centre websites.

Research is conducted differently in each country, which can be tricky when trying to compare data, as financing systems and job descriptions differ. To get round this problem, the French framework was used as a basis and an equivalence grid was drawn up for each country, to give us bases for comparison that are as similar as possible.

One quarter of the French marine science and technology training-research workforce is located in Brest

Marine science and technology researcher workforce



Marine science and technology researcher and research professor workforces (excluding private R&D) in France (workforces in excess of 100 people)

Brest	652
Paris	357
Nantes-St Nazaire	283
Montpellier-Sète-Palavas	265
Toulon	191
La Rochelle	177
Marseille	177
Bordeaux	116
Caen	112
Villefranche-sur-Mer	105

Source : directories and the websites of training-research institutes (2009-2010)

Western Brittany: the largest concentration of researchers in France

Western Brittany, with Roscoff (and its Pierre & Marie Curie University biology station) and Concarneau, houses 25 % of the French workforces involved in the maritime domain (that is 652 researchers and research professors).

The main training-research actors in Brest are the French Institute of Marine Research and Exploration (IFREMER) -the centre in Brest having the largest workforce in France- the University of Western Brittany (UBO) and its European Institute for Marine Studies (IUEM), Grandes Ecoles (mainly the Naval School, the National College of Advanced Techniques (ENSTA Bretagne) and Télécom Bretagne).

The University of Western Brittany and the European Institute for Marine Studies (UBO-IUEM) is the only French university offering marine science training that covers a wide range of fields of application². Research is also conducted in national public institutions: the marine and fluvial technical study centre (CETMEF), the naval hydrography and oceanography department (SHOM) and the Centre of Documentation, Research and Experimentation on Accidental Water Pollution (CEDRE). Roscoff's biology centre is another main actor in Western Brittany.

A wide range of applications

Brest's marine science and technology research marks itself out thanks to oceanography, marine biology, geophysics, observation (space marine remote sensing in particular), ship architecture/hydrodynamics, submarine acoustics, telecommunications applied to the maritime domain within the scope of activities related to safety and maritime security.

Paris, the other marine specialist

In terms of its workforces, Paris ranks just behind Brest. The capital boasts two essential actors: Pierre & Marie Curie University with its three incorporated stations (Villefranche-sur-Mer, Roscoff and Banyuls, all three of which have a total of 206 researchers and research professors out of a total of 563 involved in marine science at Pierre & Marie Curie University) and the Simon Laplace environmental science research institute. The number of researchers and research professors is therefore estimated at 357 in Paris (excluding marine stations), not forgetting the National College of Advanced Techniques (ENSTA) in Paris.

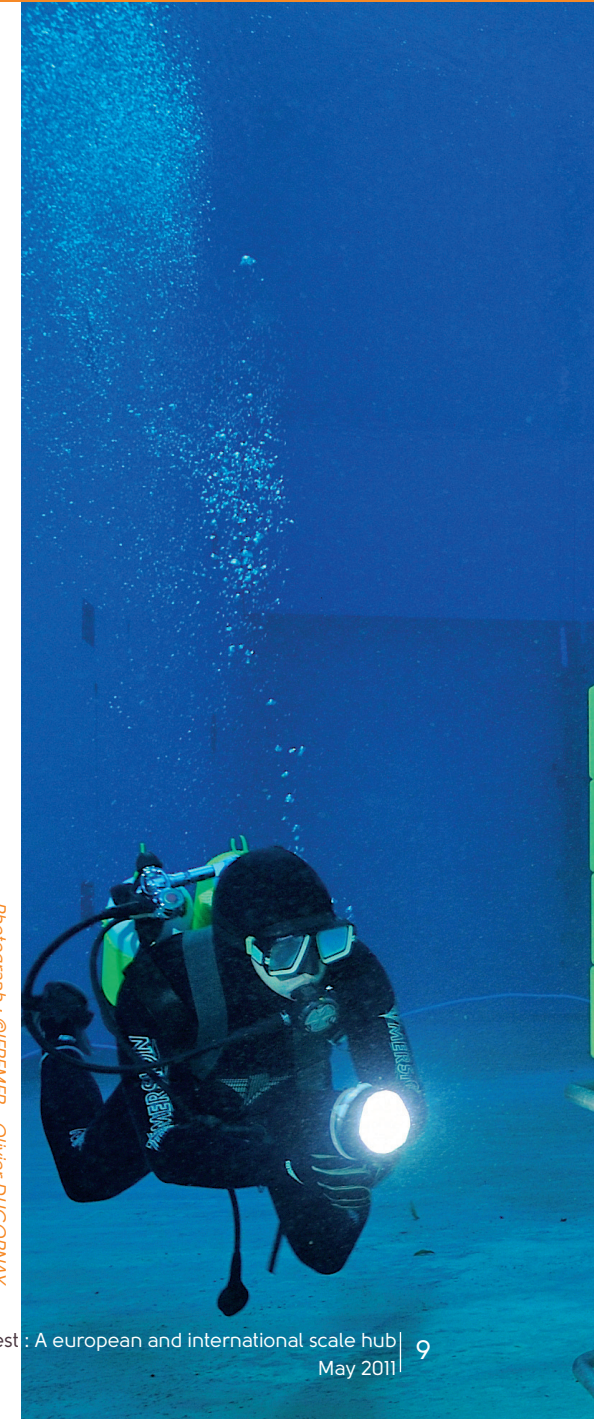
In France, two other towns are specialized in the marine domain: Nantes/Saint-Nazaire and Toulon. These towns, with smaller research workforces, have profiles more closely resembling that of Brest in terms of sectors.

Toulon has opted for naval systems and coastal and offshore hydrodynamics. Main actors in Toulon are the French Institute of Marine Research and Exploration (IFREMER) in Seyne-sur-Mer, the Institute of Engineering Sciences of Toulon and The Var (ISITV) which is attached to the University, and Supméca Toulon.

Nantes-based centres are conducting important research in naval hydrodynamics in the fields of biotechnologies and marine energies. Two major actors: Nantes' School of Engineering (Ecole Centrale) and the French Institute of Marine Research and Exploration (IFREMER). Nantes University has set up a marine and coastal centre made up of the university's existing research units, not all of which are exclusively involved in marine matters. Furthermore, Nantes' university centre is more involved in developing all aspects related to marine economy (alongside the Applied Research Centre in Maritime Economics (ISEMAR) in Saint Nazaire).

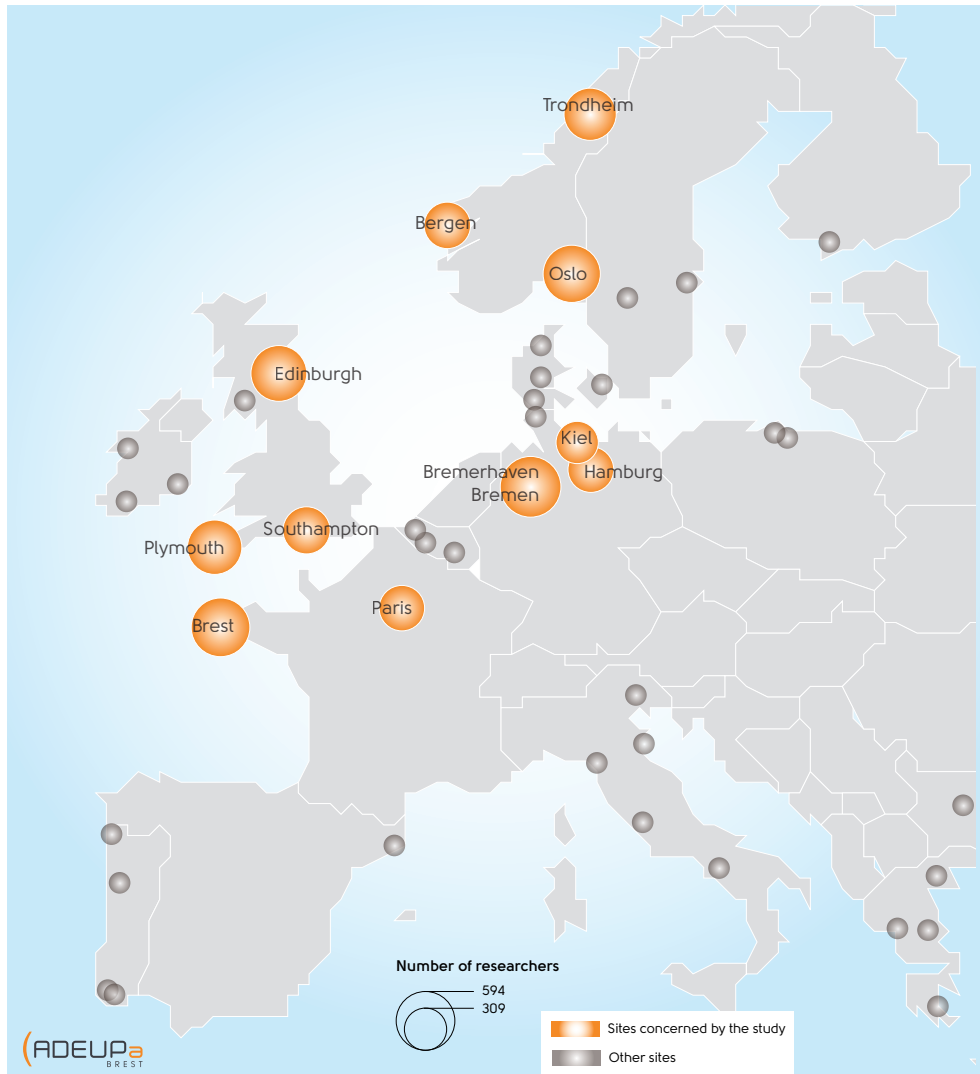
Other French towns in which marine science training-research is present are mostly focused on subjects related to marine resources (aquaculture), marine biology, the environment and coastline. These towns do not have their own Grandes Ecoles, or the means to develop research in more technical fields, such as naval hydrodynamics (related to naval construction and repair) or renewable marine energies. This is the case of Montpellier, the researcher and research professor workforces of which rank it just after Nantes-Saint Nazaire.

Photograph : @IFREMER - Olivier DUGONNAY



2. See the report entitled "Map of university activities in the field of marine science at national and international level and the position of the University of Western Brittany (UBO) - Part I: National cartography". UBO, December 2010.

A marine science and technology research workforce in excess of 300 people (Europe)



Brest has the largest researcher and research professor workforces of all European sites concerned by the study.

The method that has been adopted gives priority to concentrations of researchers to the detriment of small teams, the performances of which can of course be quite remarkable. This focus on quantity could be detrimental to quality.

The example of Spain is significant in this matter: the work of its research laboratories is acknowledged worldwide yet they sometimes have very few researchers.

At European level, the 652 scientists working in Western Brittany put the headland of Brittany in first position in terms of its workforces, in front of other panel sites concerned by the study.

Yet contrary to other French sites where the difference in workforces between Brest and the other towns is more marked, here the difference in workforces is less pronounced with Bremen and its port of Bremerhaven in Germany which totals 545 researchers and research professors and a major actor: the Alfred Wegener

Researcher and research professor workforces in marine science and technology (excluding private R&D) in Europe (workforces in excess of 300 people)

Brest	652
Bremen-Bremerhaven	545
Plymouth-Exeter	512
Edinburgh-Stirling	498
Trondheim	471
Oslo	468
Southampton	386
Bergen	374
Hamburg - Geesthacht	362
Paris	357
Kiel	309

Source : directories and the websites of training-research establishments (2009-2010)

Institute (AWI) for marine and polar research and its 290 researchers (53 % of the territory's workforce).

Plymouth and Exeter are practically on par with Bremen, the Met Office in the field of climatology and Plymouth University in oceanography and marine biology being their main actors.

The Scottish towns of Edinburgh and Stirling and the Norwegian towns of Trondheim and Oslo all have workforces ranging between 400 and 500 people.



Photograph : Technopôle Brest Iroise - René TANGUY

Few sites in Europe have such a comprehensive training-research profile as Brest

All European towns concerned by the study boast skills in oceanography, marine biology and marine resources (fishing-aquaculture).

Brest and Bergen both have researchers and research professors involved in a wide range of marine science and technology research subjects: marine biology, oceanography, marine resources (fishing-aquaculture), observation (including remote sensing), climatology, marine technologies (including submarine acoustics), ship architecture and hydrodynamics.

The other towns concerned by the study distinguish themselves in a more or less large number of such fields but never on such a scale³. Thus Plymouth, Southampton and Liverpool in England are

major sites in terms of training-research in oceanography, in marine biology, with their university actors such as Plymouth's Marine Laboratory and the National Oceanography Centre in Liverpool respectively. This is also the case of Kiel in Germany with the university's IFM-Geomar institute.

Rare skills

Relatively few of the towns concerned by the study boast such skills as naval hydrodynamics, marine technologies (including those related to submarine acoustics) or information and communication technology applied to the maritime domain. Only Brest, Bergen, Oslo, Trondheim, Rosstock, Hamburg and London have teams of scientists involved in one or several such research fields. The towns of Aberdeen and Edinburgh do have a few teams but they are relatively few and far between.

Similarly, few towns concerned by the study have a space marine remote sen-

sing radar centre. These are only found in Brest, Bergen and Tromso in Europe.

Brest concentrates a larger researcher and research professor workforce, the work of which covers a wider and more varied range of fields than all European towns concerned by the study, with the exception of Bergen which has a similar profile.

OTHER SITES WORTH STUDYING

- The Netherlands: Wageningen
- Poland: Gdansk, Gdynia
- Finland: Helsinki, Turku
- Portugal: Oporto, Lisbon
- Italy: Trieste, Rome

These countries occupy a major position within the European marine science and technology training-research landscape that would be worth studying in the same manner as panel towns presented within.

3. See Appendices: Summary tables of skills in training-research per town concerned by the study.

Workforces

of training-research that put Brest on the same level as some intentionally acknowledged sites

Contrary to national and European levels, it is more difficult to rank Brest at international level as the panel towns concerned by the present study are not fully representative of all towns internationally acknowledged in marine science and technology. It is worth remembering that the list of sites under study was drawn up by steering committee members, the latter being made up of main actors in Brest.

Yet it is interesting to see how Brest fares compared to centres such as Woods Hole and San Diego in the United States, Tokyo in Japan, Qingdao and Shanghai in China or Hobart in Tasmania.

A marine science and technology research workforce in excess of 500





Photograph : ADEUPa

The marine science and technology researcher and research professor workforces (excluding private R&D) of some major sites in the world (workforces in excess of 500 people)

Qingdao	962
Shangai	878
Hobart	700
Brest	652
Woods Hole	572
Bremen-Bremerhaven	545
Plymouth-Exeter	512
Tokyo	505

Source: directories and the websites of training-research institutes (2009-2010)

At world level, a country such as China with such a huge population has researcher and research professor workforces in very large universities and research institutes far in excess of other large centres.

Tasmania also has a very large workforce which was reinforced with the installation in Hobart in the 80s of the registered offices of the Australian Antarctic Division and that of the Commonwealth Scientific and Research Organisation's Marine and Atmospheric Research division. Since then Hobart has concentrated the largest marine science researcher workforces in Australia.

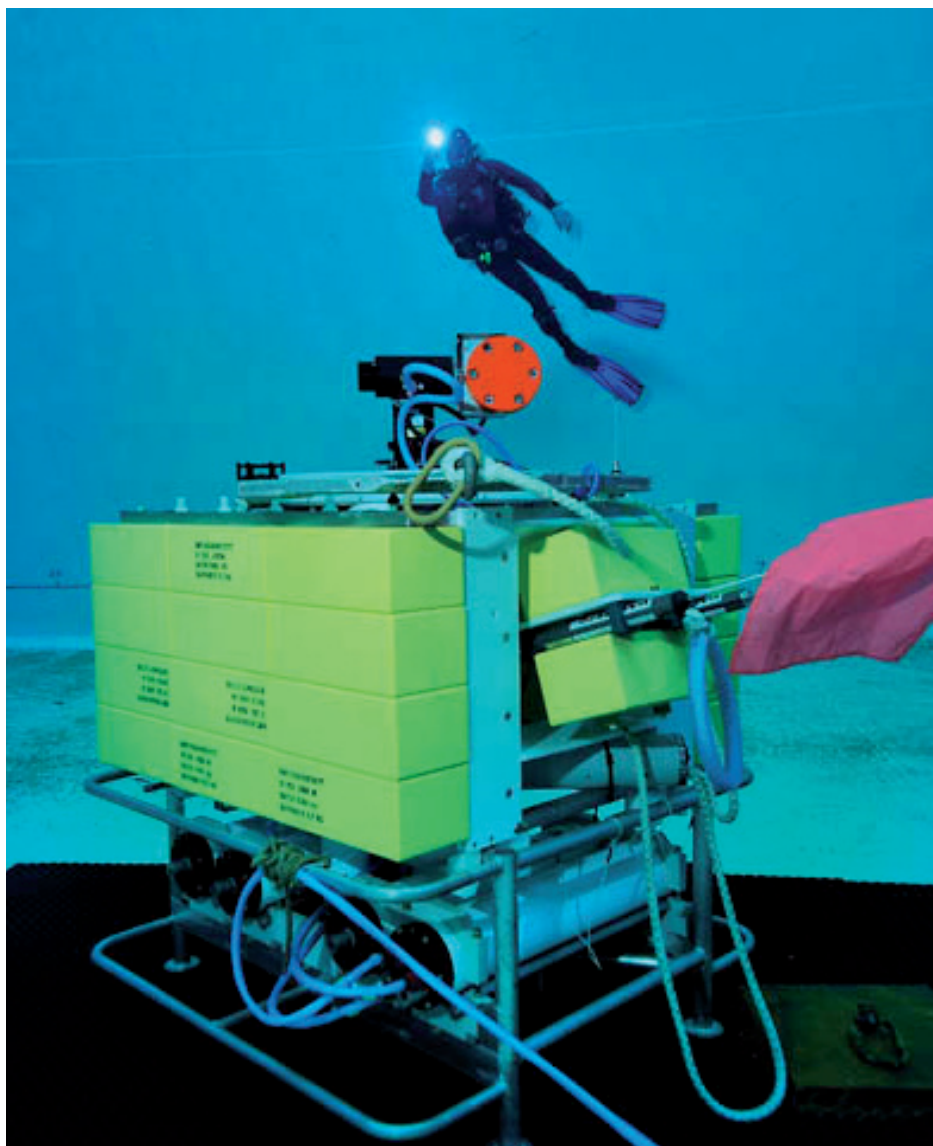
This assessment must not overshadow the essential part played by other major Australian towns in the same field: Perth (University of Western Australia) and Townsville on the northeastern coast (James Cook University).

A territory as large as the United States with its huge west and east-facing coastal façades is a good opportunity to develop a great many sites devoted to marine science and technology training-research.

The present study chose Woods Hole and San Diego as part of its panel for their very high reputation worldwide and the relationships between their researchers and those in Brest. Yet other major actors could also have been chosen, such as Columbia University's Lamont-Doherty Earth Observatory in New-York, Miami and Florida; the University of California with all its units dotted along the western coast among which we chose that of San Diego: so many actors that add to this country's huge potential in the field presently discussed.

In terms of workforces, Brest with its 652 researchers is on par with Hobart.

The headland of Brittany even boasts workforces in excess of those of Tokyo in Japan yet the latter figures among countries to be reckoned with in the field of marine science and technology, with actors such as JAMSTEC, and the National Marine Research Institute and Tokyo University.



Photograph : ©IFREMER - Olivier DUGORNAY

Research fields similar to those developed by researchers in Brest

Among the towns studied at International level, all offer a range of research subjects that are common to those developed in Brest.

The research subjects common to all these towns are essentially observation, oceanography and marine biology.

OTHER PLACES WORTH STUDYING

- Canada : Vancouver, St John's
- Brazil : Rio, Sao Paulo, Recife
- Mexico : La Paz
- United States : California, Miami, New-York...

These countries occupy important positions within the International landscape of marine science and technology training-research that would be worth studying in the same way as the panel towns detailed within.



Photograph : ©IFREMER - Olivier DUGORNAY

Tokyo and Brest :

the only study panel towns to have put a wide range of scientific research resources at the disposal of their scientific communities.

It takes more than the number of researchers and research professors to assess the performance of a territory in one or several fields of marine science and technology.

This is why we chose to take a look at a certain amount of equipment and scientific research resources in each study panel town. The simultaneous presence of these different resources on one given site (regardless of the technical performances of such and such a resource considered separately) is proof of the scientific community's wish to conduct high quality research work.

Choice of markers and usual precautions

Concerning these scientific research resources, we chose exceptional resources and equipment which, when present together on the same site make for excellence and effective research work.

Five types of research resources were chosen:

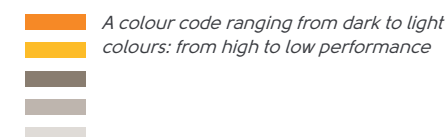
- Supercomputers (and their power)
- Model testing basins and towing tank (and their volume of water)
- Ocean research vessels according to their length and port of registry (see appended table stating the port of registry and names of the owner and operator for each vessel)
- Observation departments (with the observations sites and in situ measurement programmes)
- Database centres (with their range of influence: national to international)
- Mass spectrometers have been inventoried but have not been used for the summary.

We have recorded the technical specification of each one of these research resources: see details of this data appended to this document.

Available scientific research resources throughout panel town territories with researcher/research professor workforces in excess of 500 people and four towns with substantial resources despite workforces of less than 500 people

Localisation/ Territory		Tokyo	Brest	San Diego	Hamburg Geesthacht	Bergen	Hobart	Shangai	Paris (UPMC)	Bremen- Bremerhaven	Plymouth - Exeter	Qingdao	Woods Hole
Supercomputer (in teraFLOPS/s)		131	23	100	158	51		233	268				
Model testing basin and towing tank (total available testing volume)		63 698	14 502	7 422	32 400			9 330		NR			
Ocean research vessels (according to port of registry)	Number of vessels from 60 to 100 m long	2	3	2	2	2	1				1	4	2
	Number of vessels of over 100 m long	5	1	1			1	2		1		3	
Observation departments	Observation sites	3	8			10			3		5		2
	Programmes / in situ measu- rem	2	7	2	1	2	3			2	1		2

Source: the websites of training-research institutions and yearly reports



The resources put at the disposal of a town's scientific community indisputably reinforces its image, reputation and obviously also the capacity of its researchers to make headway and conduct quality research work.

In view of the scientific research equipment at the disposal of the towns listed in the table above, Brest and Tokyo are the only towns to have all of those resources⁴. Some of them give Tokyo far higher tech-

nical performances than Brest (such as the supercomputer, the total volume of water available in the model testing basins and towing tanks and the ocean research vessels measuring over 100 m long). But this is also about checking the concomitance of resources within the same territory which, when used together, increase

4. Appended to this document are the technical specifications for each one of the chosen scientific resources and for each town concerned by the study, even those not included in the panel for certain resources such as supercomputers

their respective capacities (such as Brest's supercomputing centre). The main points that set Brest apart from Tokyo are its in situ measurement programmes and the international influence of its database centres.

The other towns listed in the table above do not have all the listed equipment, but the high performance of the equipment they do have justifies them being listed within.

Following Tokyo and Brest, San Diego is the next town to have the largest number of cited resources. These are essentially the resources of the Scripps Institution of Oceanography, part of the University in San Diego, California (UC San Diego).

The HSVA (Hamburgische Schiffbau – Versuchsanstalt) in Hamburg, with its supercomputer and its very large model testing basins and towing tanks has high performance resources suited to its areas of

excellence, one of which is ship architecture.

Bergen has resources which once again put it on par with Brest in terms of their similar marine science and technology research profiles: their observation resources (in situ measurement programmes, observation sites, ocean research vessels) and a supercomputer.

Shanghai and Paris enjoy substantial computing power yet invest less energy into developing other types of research resources. Because Paris is far from the coast, it relies on marine biology stations for other types of equipment.

The two Chinese sites concerned by the study do not appear to have much equipment but access to such information is limited, so they may well be better off than we know.

Plymouth and Woods Hole have developed resources suited to their areas of excellence in marine science (marine biology, oceanography, observation): a smaller range but in keeping with the average in terms of the individual performance of its equipment for Plymouth in particular (see above).

Photograph : @IFREMER - Olivier DUGORMAY



2. Influence

The influence of marine science and technology research activities has been measured thanks to the European Union Framework Programmes for Research and Technological Development, also called Framework Programmes or abbreviated FP1 through FP8 (FP). This marker is therefore only relevant to the European Union and was not extended to other international research programmes (ARGO, CLIVAR, IODP, POGO...) through lack of time. The influence of this marker must be put into perspective as influence can only be measured by the yardstick of partnership programmes. This can be used to compare the degree of openness of some sites and their wish to collaborate with other actors but it is insufficient to establish a hierarchy on this basis alone.

Choice of markers and usual precautions

We have analysed Framework Programmes 6 & 7. With regard to the latter, the projects we looked at are those that match invitations launched and closed in 2007 and 2008.

It is worth noting that FP6 lasted 5 years (2003-2007) and that FP7 is scheduled to last 7 years (2007-2013).

Several criteria were chosen to analyse the marine science and technology projects registered for FP6 and FP7:

- The coordination institution and its geolocation (in relation to the town): can be a training-research organization, a research centre or a private institution (company).
- Partners and their geolocation (in relation to the town)
- The amount financed by the European Union for each project.

A number of institutions are registered with the project according to their parent organization (most of the time, when they are dependent on research organizations the latter's name is given) which makes it even more difficult to geolocate the institutions that are really stakeholders in the project. This has been done whenever possible but not exhaustively. Consequently, some towns appear as major actors: this should be partly attributed to the "capital" effect, with the presence of these national organizations.

We have appended a comprehensive table of coordination and partnerships within the scope of FP6 and FP7 projects per institution studied within each panel town.

FROM THE PANEL OF SELECTED TOWNS :

French rating according to the number of coordinated projects

At national level, Brest's actors stand out with a number of coordinated projects far superior to those of other national actors during FP6.

During the first two years of FP7, Brest's actors were far less present in terms of coordinated projects in the maritime domain. This obvious decline is being made up for in 2010 and 2011, not forgetting that FP7 is not yet closed.

Paris, Ramonville (since 2009) and Brest concentrate substantial financial volumes owing to their coordination of a large number of European programmes. Nantes and Roscoff play a more modest part at this level.

Rank	FP6	FP7
1	Brest	Brest / Nantes-Saint-Nazaire
2	Marseille	Paris / Montpellier
3	Paris / Roscoff / Nantes-Saint-Nazaire	
4	Montpellier	

European rating according to the number of coordinated projects

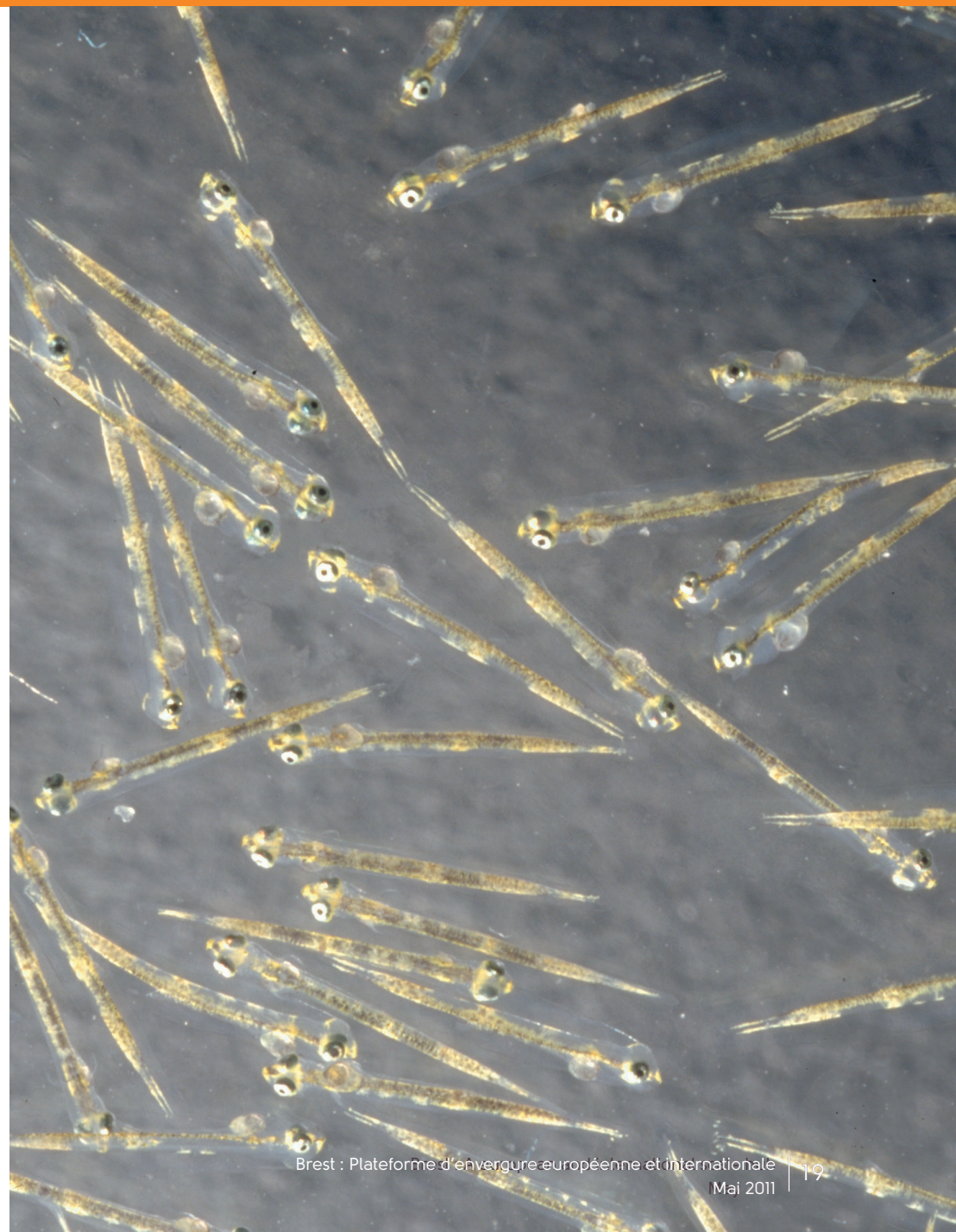
At European level, Brest's actors in marine science and technology come 1st among study panel towns alongside Bremen in the scope of FP6 (12 coordinated projects for both towns).

On the other hand, the drop already recorded in the scope of FP7 at national level becomes even steeper at European level with Brest sliding off the scale of 5 top towns boasting the highest number of coordinated projects.

Up until 2008, Brest and Paris were the European leaders in terms of mobilizing finances for European programmes, in front of Bergen, Hamburg, London, Wageningen and Genes. As from 2010, Ramonville overtook Bergen, Hamburg, London, Genes and Augsburg, followed by Wageningen, Paris and Roscoff.

Rank	FP6	FP7
1	Brest / Bremen-Bremerhaven	Bremen - Bremerhaven
2	Plymouth - Exeter	Madrid
3	Southampton	Plymouth / Londres / Barcelone
4	Bergen	Edinburg - Stirling
5	Marseille / Lowesoft	Kiel / Bergen / Southampton

Photograph: @IFREMER - Olivier DUGORNAY



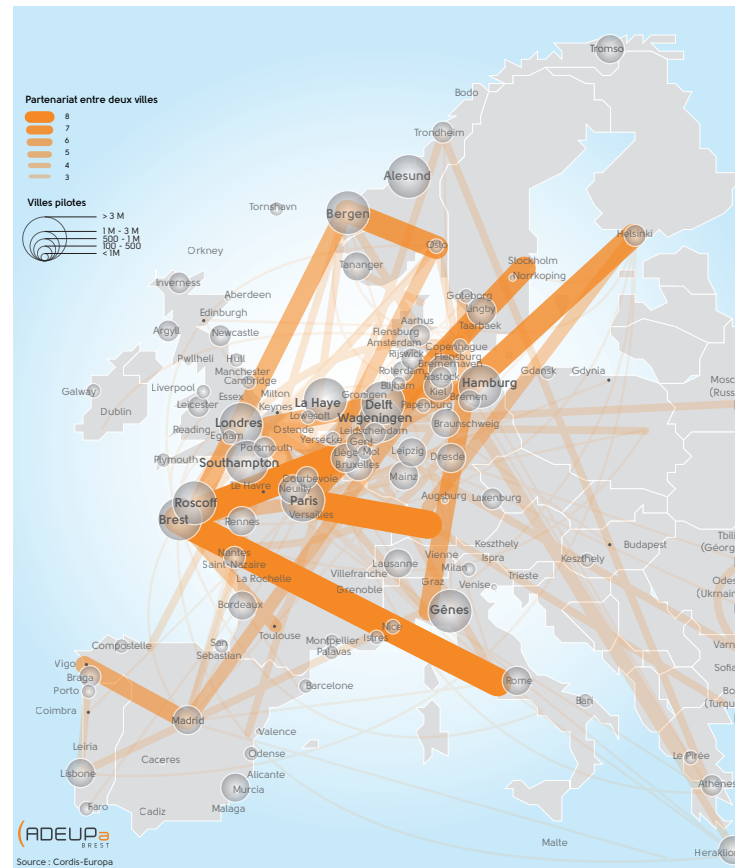
Partnership relationships within the European projects (FP6 & FP7) per year; the presence of Brest's actors dwindles from 2007 up until 2009.

Regarding the partnership relationships that unite marine science and technology actors of various European towns, the aforementioned observation regarding the dwindling presence of Brest's actors is confirmed. This takes into account both participation and project coordination (represented by circles that also indicate financial volumes managed).

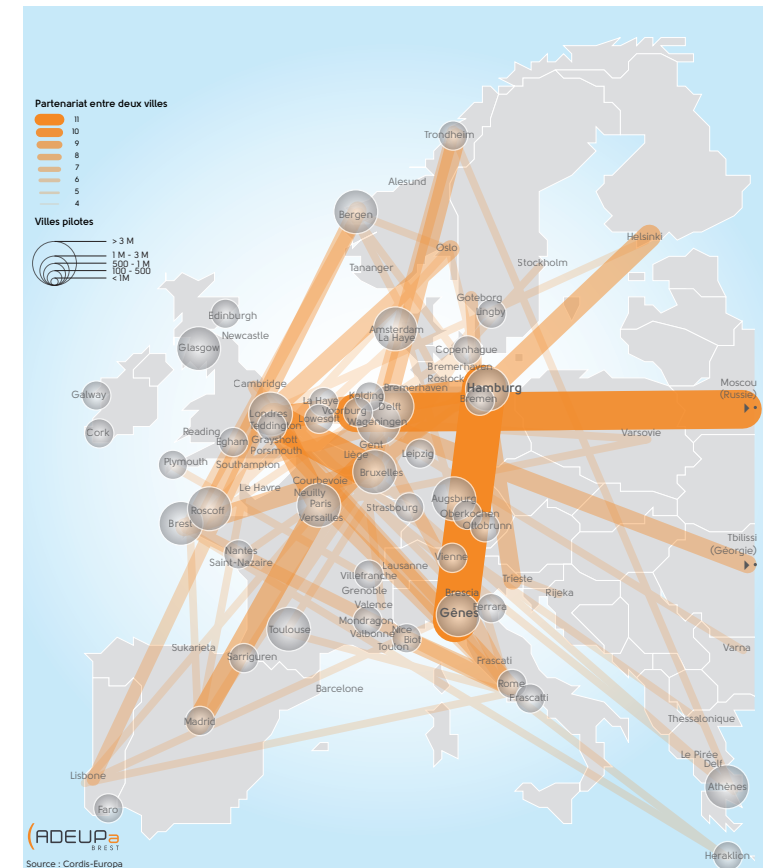
The "capital" effect mentioned earlier is once again felt for towns such as Paris, Rome and Brussels... the latter therefore probably being overrepresented. However, these maps show large marine science and technology centres: Brest is unquestionably present until 2007-2008, when it began to decline. The study panel towns already highlighted thanks to previous markers now stand out, as is the case of Bergen and Hamburg.

Brest's privileged partnerships with Bergen are identified as early as 2005 (also Roscoff-Bergen).

Partnership relationships within European projects in 2007



Partnership relationships within European projects in 2009



3. Scientific production

Our third main line is hinged on the bibliometric marker generally approved by the scientific community to measure researchers' scientific production. This is therefore also a visibility marker for the scientific domain in question, in this case marine science and technology.

The impact factor measures the reputation of a scientific journal (which is calculated once a year). The average impact factor of an institution is calculated according to the impact factor of journals in which that institution's researchers and research professors have published their articles.

Choice of markers and usual precautions

The bibliometric marker has been collected thanks to the Web of Science (WOS) database at the Bibliothèque La Pérouse in Brest. Research concerned the following 6 sub-bases of the Web of Sciences: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH and IC.

For each institution, a "sea" related equation was applied, a cross between the two specific equations. The following restrictions were then applied:

- Types of journals: articles, proceedings papers, reviews, letters.
- Reference years: 2006-2009.

On the basis of this collection, we were able to define:

- the average number of articles published in marine science and technology per institution, then aggregated per town,
- the average impact factor for each institution for the years 2006-2009.

To calculate the impact factor, we chose A-ranking journals read at international level. As an aggregate average impact factor per town could not be established, the highest average impact factor for a given town was chosen for comparative purposes.

This chosen equation sets its own limits in the choice of terms, as the equation focuses on "oceanography" and does not pick up on the term "maritime" » (expressed as "marit*") in order to avoid broaching themes that are of no interest to our present study.

Conversely, this at least partially excluded some results related to research concerning marine technologies (conducted within engineering schools in particular).



Photograph: Franck Belermin

A yearly average of the number of marine science articles published which highlights Brest at national and European levels

At national level, Brest ranks just after Paris. Paris's case is specific as published articles are those of Pierre & Marie Curie University and its three incorporated stations: Villefranche-sur-Mer, Banyuls and Roscoff. The gap between both towns is actually smaller when the latter is linked to Brest. This comparison wasn't attempted as it would have meant searching through all the articles published by Pierre & Marie Curie University, to find all those written by researchers belonging to the station in Roscoff.

At European level, Brest, Bremen-Bremerhaven and Bergen stand side by side with a practically identical yearly average in numbers of published articles. This confirms the close proximity already observed between the profiles of Brest and Bergen.

The results of Plymouth and Southampton, England's two main towns in terms of oceanographic research, are identical.

Town	Yearly average number of published articles in marine science and technology (> 200)
Paris	573
Bremen-Bremerhaven	436
Brest	435
Bergen	432
Plymouth	321
Southampton	319
Barcelone	271
Trondheim	241
Marseille	234

Woods Hole and Tokyo, which have smaller researcher and research professor workforces than Brest, boast a yearly average number of published articles far superior to those of the three leading European towns (Paris, Brest and Bergen), thus confirming their excellent reputation and visibility in terms of research.

Articles published by Chinese institutions have not been included in the present calculations. Results would be too low as the articles of Chinese scientists are mostly published in national journals.

Town	Yearly average number of published articles in marine science and technology (> 300)
Tokyo	832
Woods Hole	652
Paris	573
Bremen-Bremerhaven	436
Brest	435
Bergen	432
San Diego	394
Plymouth	321
Southampton	319

A less favourable position from the point of view of the impact factor of published scientific articles produced in the headland of Brittany

As detailed earlier, the impact factor is a way of measuring the impact produced by journals in which researchers and research professors publish their articles. This marker is accepted by the scientific community and has not been questioned despite its limitations. Yet two arguments do indeed undermine the influence of this marker. On the one hand, the journals are selected according to very precise subjects: health-medicine, physics and chemistry. Yet marine science and technology does not fit into just one subject category, it encompasses several. And on the other hand, all these journals which are identified and impact factor rated every year, aren't equally available to the whole of the scientific community.

Town	Average impact factor (> 3)
Plymouth-Exeter	5
Bremen-Bremerhaven	4,8
Hamburg	4,4
Londres	4,1
Southampton	3,9
Tromso	3,8
Kiel / Paris	3,7
Barcelone	3,6
Bergen / Marseille / Liverpool / Oslo	3,4
Lowesoft / Nantes	3,1
Brest / Lille / Bordeaux / Palma de Mallorca	3

At European level, threshold number 3 can be adopted as the highest impact factor observed among study panel towns. Brest only just makes it, a result that can be considered correct although this does not show the town in a favourable light compared to other panel sites and poses the problem of the researchers' access to leading international journals. This result can also be explained by the subjects of published research articles. Highly specialized research subjects concerning equally specialized subjects rarely discussed elsewhere undoubtedly have more trouble being published in top leading international journals.

Conversely, English and German scientists head the field with high impact factors.

3.5 on the impact factor scale must be reached to hope to be read worldwide. Anglo-Saxons, lead by the Americans, monopolize leading impact factor positions, a result that may be due to their proximity to towns that boast the most prestigious journals.

Town	Average impact factor (> 3.5)
Woods Hole	5,9
Plymouth - Exeter	5
Bremen-Bremerhaven	4,8
San Diego	4,6
Hamburg	4,4
Londres	4,1
Southampton	3,9
Tromso	3,8
Kiel / Paris	3,7
Barcelone	3,6

SUMMARY

The objective of the present study is two-fold: to identify Brest's areas of excellence in marine science and technology and define its position within the group of sites devoted to this specialized field at European and world level. More than a mere marker, the method adopted within favours a multicriteria approach without establishing a hierarchy among them.

Human and scientific resources put Brest and the headland of Brittany in top position at national and European level. 652 researchers and research professors and a wide range of resources – research equipment make it an essential marine science and technology site. The main sites Brest can pit its strength against are Nantes and Toulon in France and Bergen and Bremen-Bremerhaven in Europe, and at international level, Brest is on equal footing with such world-famous sites as Woods Hole, San Diego and Tokyo.

Brest also has a wide range of research subjects: oceanography, marine biology, geophysics and more technical subjects that revolve around marine hydrodynamics, submarine acoustics and ICTs applied to the maritime domain.

The signs of the influence and visibility of marine science and technology research in the headland of Brittany: a leading position regarding the coordination of European project and the management of financial funds related to such projects. Yet since its peak in 2007-2008, Brest seems to be have been on the decline ever since. The articles of Brest's scientists are published in leading international journals and from this point of view the researchers of Anglo-Saxon and German sites are far more efficient. This is essentially due to their closer proximity to international journals.

Brest has a scientific marine science and technology centre that performs highly from several points of view (workforces, research equipment and coordination, including the financial coordination of European projects) which puts it in a leading position in France and Europe. These facts are however moderated by other less favourable factors attributable to Brest's geographical distance from decision centres (scientific production and less favourable development in terms of European project coordination).





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