Irish Marine Institute:

Nurturing Ireland's emerging "blue economy" by listening to sensors in the sea

Dr. Peter Heffernan
Chief Executive,
Irish Marine Institute

Though separated by roughly 1,900 miles of the cold North Atlantic, Ireland and Newfoundland share an enduring bond that traces back to the early 1700s, when Irish immigrants began settling Newfoundland in large numbers. Though more than half of Newfoundlanders today claim Irish descent, their connection goes well beyond the sentimental. The two countries also collaborate closely on the economic front, perhaps most visibly at the nexus of maritime industries and information technology.

Around 2007, such a partnership brought Dr. Peter Heffernan, Chief Executive of the Irish Marine Institute, to Newfoundland's Placentia Bay, known for its rich fishery and environmental sensitivity. He was working with counterpart scientists from the local marine institute, along with provincial government officials, on a way to combine sensors and communication technologies to track the ocean's vital signs. The initiative's holistic aim was both to protect the region and to provide a broader resource – in the form of usable data – to the stakeholders whose lives revolved around the bay's maritime economy. It came to be called SmartBay, and Heffernan took that idea back across the Atlantic to the rugged shores of Galway Bay.

Leadership Spotlight

Dr. Peter Heffernan, Chief Executive of the Irish Marine Institute in Galway, Ireland, sees the "blue economy" as one of the key engines for Ireland's future economic growth. Under his leadership, the Institute is helping to make Galway Bay a model of smart ocean practices.

How Irish Marine Institute got smarter

Since its founding 20 years ago, the Institute has played a role that straddles the realms of marine science and economic development. As sensors have become cheaper, more abundant and more sophisticated, the Institute envisioned their widespread deployment in the ocean as an essential building block of a "smart-ocean" strategy. To advance this aim, the Institute was the catalyst to the formation of a diverse cluster of innovators who are using real-time data – streamed from sensor enabled buoys in Galway Bay – to develop analytical and predictive models that help the maritime community interact more intelligently with their ocean environment.

Promoting the blue economy

Asked to describe the mission of Irish Marine Institute, Heffernan is characteristically modest: "We provide science advice and build science programs to unlock the [ocean's] potential in an environmentally sustainable manner." Science may be the Institute's charter, but it also serves as a kind of advocate for Ireland's maritime community and, more generally, as an agent of economic development. Heffernan believes fervently in the potential of the "blue economy" – that diverse and interlocking network of economic players that rely on the ocean – to set Ireland on an upward trajectory of growth, prosperity, and sustainability. He saw in Galway Bay a near-perfect test case of how the principles of SmartBay could help trigger a new growth phase for the region.

While Heffernan's vision of the emerging blue economy encompasses a wide range of largely familiar sectors, from commercial fishing and shipping to tourism and offshore oil and gas operations, it also sees an increasing role for ocean-based businesses in their relative infancy. For instance, deep water aquaculture or "fish farming" represents a growing food source and business opportunity. And with the west coast of Ireland constantly pounded by large ocean waves, the ability to convert their energy into marketable electric power has the potential to make Ireland largely energy self-sufficient.

From a SmartBay perspective, what today's and tomorrow's blue economy activities have in common is the degree to which they could all be done better with more information. That much isn't new. The big breakthrough, says Heffernan, is on the sensor side of the equation. "Sensors are becoming more powerful and versatile in what they can detect, and cheap enough to deploy on a large scale," Heffernan explains. "This trend will enable humans to make a huge leap in understanding what's going on in the ocean, and to make smarter and better informed decisions in the way human systems interact with the ocean environment."

Bringing innovators to the table

Such a scenario wouldn't unfold on its own. Inspired by the Newfoundland experience, Heffernan and his team envisioned a clear role for the Institute in incubating and jump-starting the innovation cycle required to bring sensor-driven intelligence into Ireland's blue economy. As a hub of Ireland's maritime community, the Institute was uniquely positioned to act as a facilitator of collaborative innovation on two levels. First, it had the institutional connections within the maritime community that would enable it to bring together key stakeholders from business, academia and government to form a cluster of innovators, each with something to bring to the table.

But just having ideas wouldn't be enough. Heffernan's team realized that to trigger true innovation within the cluster, it needed an open technical infrastructure to build and test new ways of using the diverse data gathered by ocean-based sensors. The team also recognized the need to establish a set of baseline sensing capabilities for Galway Bay that would serve as a starting point that could be built up over time.

It was 2008 when the realization of the Galway Bay SmartBay vision began in earnest. One indication of the advanced state of the Institute's planning came when IBM, which had been in discussions with the Institute, decided to establish an IBM Centre of Excellence for Water Management in nearby Dublin. Soon after, the Institute began working with IBM and a number of other consortium partners from government, business and academia to develop a pilot known as the SmartBay National Research, Test and Demonstration Platform. Developed using cloud technology, the solution is comprised of three distinct components. The first is a series of sensor-enabled buoys positioned across Galway Bay. The second is an integration platform prototype that unifies the captured sensor data into a common database. The third (also a prototype) is a suite of analytical tools that are accessed through a portal interface.

The benefits of Galway's SmartBay solution

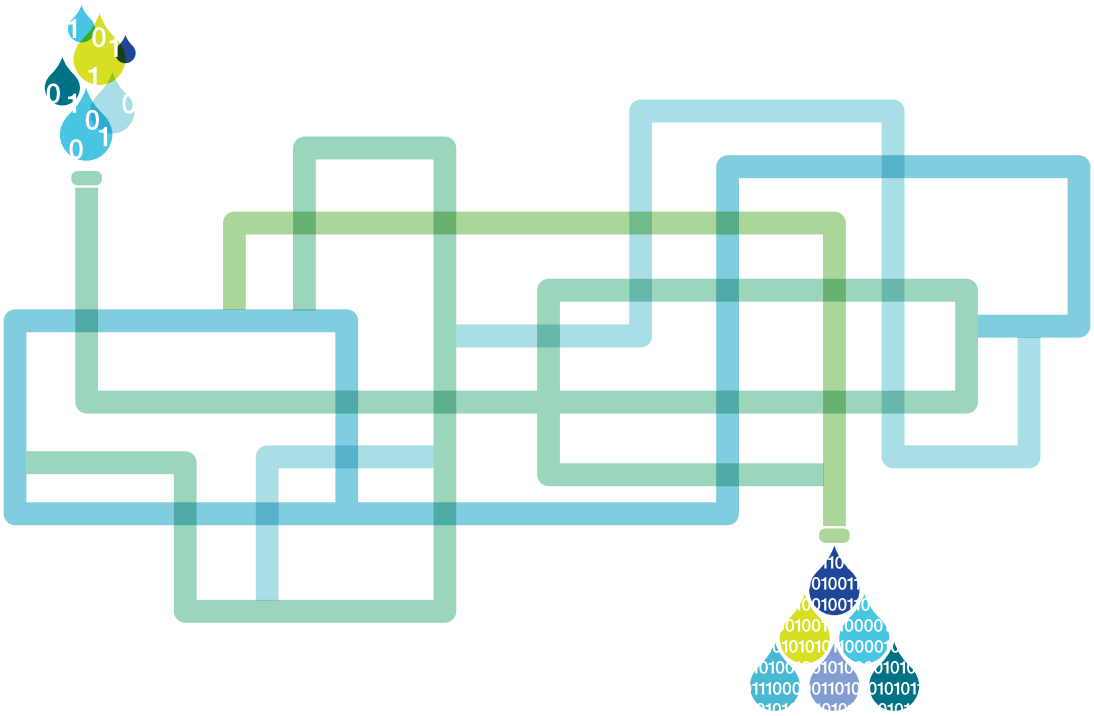
- Secured €3.8 million in funding from Irish government
- Provides a stimulus to the Irish economy by creating a "smart ocean" cluster of entrepreneurial activity
- Positions Ireland to be a leader in the emerging blue ocean activities such as wave power generation
- Increases the efficiency and safety of existing maritime activities through the optimization practices made possible by real-time tracking of ocean and weather data

Making waves in Galway Bay

The initial building block of the platform, first put in place three years before the SmartBay initiative, is a test and demonstration site designed to support companies developing wave energy converters, large floating devices that translate ocean wave motion into electricity. Using sensors positioned from the surface to the seafloor, company technicians are able to use readings of wave height, frequency and other parameters to essentially "tune" their converters to obtain optimal performance under different wave conditions. A few kilometers away, the team deployed another buoy to capture a variety of weather data. Together, the network of smart buoys provides a rich stream of easily accessible data that, by design, represents the building blocks of a host of practical new services for the maritime community.

To solicit additional input on potential new applications, the team's researchers fanned out to Galway's maritime stakeholders. When they spoke with the city's harbormaster in his office on the flood-prone River Corrib, located a short distance from where it flows into Galway Bay, they heard about the pressures he faced during bad weather to assess the risk of flooding for city officials. With his credibility on the line, the harbormaster was forced to balance the risks and costs of false alarms and missed signals. Using the SmartBay portal, the team built a proof-of-concept predictive model that pulled together sensor-based data on tide, rainfall, barometric pressure and wind speed to "score" the risk, and issue a clear "red light/green light" advisory to city officials, thereby reducing the reliance on manual data gathering and gut intuition.

From Galway's fishermen, the team heard about the navigational hazards of loose, often large objects floating in the bay, whose locations were tracked based on visual sightings and ad hoc, word-of-mouth communications among fishermen. In Galway's well-connected maritime community, word travels fast. So when a local startup caught wind of the fishermen's need, its developers used the SmartBay portal's sensor-driven data feeds to build a predictive tracking model that allows fishermen to report the GIS coordinates of stray objects via a text message, and then applies wind, tide and current data to calculate the most probable projected path for the object – just like meteorologists do with hurricanes.



Leadership is...

Knowing when to facilitate with a light touch

In promoting smart ocean initiatives, Irish Marine Institute saw its primary role as that of an enabler – and scrupulously stuck to it.

"We never prescribe. [Our aim] is very much to create a dynamic environment that triggers the bilateral and multilateral exchange of ideas across everyone in the cluster."

– Dr. Peter Heffernan, Chief Executive, Irish Marine Institute

Lessons learned...

Maximizing the inclusiveness of the SmartBay cluster

Getting small, entrepreneurial companies involved is essential for innovation clusters to work. The institute found that small companies were a lot more comfortable – and felt less risk – taking part in government-led consortia when large companies were also involved.

"There's an increasing trust bond between very small Irish companies and multinationals that's really exciting. These are the folks who are going to come up with the solutions."

– Dr. Peter Heffernan

Innovation at close quarters

To Heffernan's team, these initiatives seemed to affirm the idea that with the right tools and environment, communities like Galway can come together to solve real-world problems. What was needed – and the Newfoundland experience had made it clear – was for the Institute to create an institutional framework to bring together a cluster of common and interlocking interests in the maritime domain. So they took action. First they solicited input from a wide array of stakeholders on what the vision, goals and strategy of this "ocean cluster" should be, thereby creating a firm foundation of consensus. Then they brought them together, literally.

Heffernan's team envisioned the first SmartOcean working group, convened in 2010, as a way to catalyze the exchange of innovative ideas within the cluster community. "We wanted to create a forum for collective brainstorming, while at the same time providing a lot of space for the private, deep-dive conversations that these interactions spawned," Heffernan explains. "Our role is not to guide the direction or content of these exchanges, but to create the conditions for relationships to form and grow within the smart ocean community." Since its forming, the group has grown to roughly 70 organizations, from local entrepreneurs to multinational companies and major Irish universities.

Irish Marine Institute: The parameters of a smart ocean cluster

Instrumented

Sensors deployed throughout Galway Bay constantly stream data on physical, chemical and organic conditions to a centralized data repository.

Interconnected

The SmartBay portal enables cluster participants to easily assemble real-time data streams into practical services.

Intelligent

Combining real-time ocean data with algorithms has enabled cluster members to develop predictive models that have increased navigational safety, enable more accurate flood planning and faster response to environmental crises like phosphate plumes.

Progress pays off

Though a scientist by training, Heffernan had to occasionally play the role of salesman, especially when pitching the benefits of belonging to the working group to larger enterprises, ranging from technology providers to oil and gas companies. In each case, it was necessary for Heffernan's team to adapt the broader smart-ocean message to align with each company's specific business and industry interests. The bigger selling challenge, however, was in convincing key members of the government – from agencies to cabinet-level officials – to make the smart ocean program an important research priority for Ireland as a country and to provide funding for additional research and infrastructure. Impressed by the progress the SmartBay consortium had already made, the Irish government awarded it a grant of €3.8 million.

That's just one measure of success. To Heffernan, what's really rewarding is to see the innovation potential of the SmartBay consortium bear fruit. Such as when a Limerick-based company called EpiSensor picked up the idea for a sensor to detect levels of oxygen-depleting phosphates in the ocean, and, in the span of just a year, brought a product to market. "SmartBay was founded on the belief that intelligent sensing will provide the key to a new level of understanding of and interaction with Earth's least explored environment," says Heffernan. "We see a clear role for collaborative clusters like SmartBay to incubate the innovations that will make this vision a reality."

Irish Marine Institute's SmartBay solution uses…

Software

IBM InfoSphere® Warehouse,
IBM WebSphere® Portal,
IBM WebSphere Application Server,
IBM WebSphere MQ,
IBM WebSphere Sensor Events,
IBM DB2®Alphablox®

Services

IBM Centre of Excellence
for Water Management (Dublin),
IBM SmartCloud

For more information

Please contact your
IBM sales representative
or IBM Business Partner.

Visit us at:
ibm.com/smarterplanet/water

Let's Build a Smarter Planet

ODC03220-USEN-00