Case study 9: Research institute has successfully found alternative applications and significant returns for technologies developed through work on ITER (VTT)

The company

VTT Technical Research Centre of Finland Ltd is a Finnish research organisation founded in 1942. Originally a public organisation it became a not-for-profit, state owned limited company in 2015. It employs more than 2,300 staff and has a total turnover of €258 million, of which €73 million comes from a government grant. It serves clients both public and private, and domestic and international. As a leading European research institute, it produces research in many different fields, but focused on the following key areas:

- Bioeconomy and circular economy
- Health and wellbeing
- Digital society
- Low carbon energy
- Smart industry – VTTs work on fusion energy is a combination of this area and smart energy systems (low carbon energy area).
- Sustainable and smart cities
- Business development
- Pilot plants and R&D infrastructure

In 2017 it was involved in 237 inventions, more than 1,400 patent applications and the publication of 610 scientific articles.

Main case-study characteristics

VTT have been involved with fusion energy dating back to 1995, and since 2001 has had continuous involvement in fusion energy related research through EFDA and then F4E and IO contracts. VTT is focused on multiple areas related to fusion energy, these include:

- Plasma physics
- Materials science
- Remote handling

VTT, with its close partner Tampere University of Technology (TUT), were selected to host the DTP2 research environment as part of the TUT international Remote Operation and Virtual Reality Centre (ROViR). This is an important source of work related to fusion energy in the area of remote handling related to the divertor. The main F4E contract identified in the dataset from F4E in which VTT is involved is a €70 million contract to a consortium led by Assystem UK.

Main characteristics	
Company	VTT
Country	Finland / Worldwide
Contract title	Preliminary Design of the DRHS-Phase 2 (OMF-340)
Contract value	EUR 70M (amount for VTT unclear – this value is for whole consortium led by Assystem UK) Involvement in multiple other F4E contracts since 2008, primarily related to remote handling and working closely with TUT.

Contract period	2010 – Ongoing (Consortium)
ITER Component	Divertor Remote Handling System
F4E Work Package Code	23

Description

As part of the operation of the reactor a divertor is used, this collects any hot ashes or impurities from the fusion reaction chamber. This divertor is made up of 54 large (3.4m x 2.3m x 0.6m) cassettes, each weighing 10 tonnes. These need to be removed for treatment and replacements inserted, with millimeter precision, using remote handling system. The DTP2 facility has been used to carry out design reviews, enhancements and demonstrations of the cutting edge remote handling technology being developed by VTT in partnership with TUT.

Main impacts

New business opportunities

VTT noted that by undertaking contracts for F4E it has been able to gain many more contacts in industry, and these are proving useful for exploiting new synergies and exploring new business opportunities across VTT as a whole, not just in the area of nuclear. Specific opportunities were identified in the areas of nuclear decommissioning, mining and the space industry.

It finds that most of its main technological developments and spin-offs tend to emerge from cooperation with universities, particularly, but not only, TUT. The process often involves the cooperation with universities in discovering or developing a particular technology or material and then to turn this into an application in the fusion sector and beyond. Examples of such technologies and their further applications include:

- A tool for the design of complex systems;
- Augmented and virtual reality tools – also used in the space industry;
- A new technology for cleaning dust from irradiated products – also used for surface treatment in metal industry, electronics, apart from nuclear);
- Sensor technologies (via F4E diagnostics contracts).

The latter two developments have been particularly successful, with the economic returns in the non-fusion sectors already surpassing the returns in the fusion sector. It was not possible to quantify these effects exactly, but a Principal Scientist at VTT felt that returns x2-3 bigger than the initial investment are being made, which compares favourably with other sectors in which VTT works.

Employment and growth

VTT employs around 50 people that work on fusion-related projects, with a relatively even split across the 3 main work areas of plasma physics, materials science and remote handling. The remote handling team is one specific example of employment growth, with the team employing only 2 people in 2005, having now expanded to 15 employees. This being driven by large grants from F4E for demonstration projects for remote handling including control system development and diagnostics.

Human capacity building

People working in fusion-related activities at VTT tend to have experience in the simulation of plasma physics, materials, and radiation environment applications, and are therefore highly skilled with

Masters degrees or PhDs. During the fusion projects several researchers have been able to upgrade their competences to PhD level.

Innovation and technology transfer

VTT has created significant IP as a result of its work on ITER, but not patents as these are more difficult for it to follow up. Nevertheless the IP that is generated through the work on ITER is felt to provide good opportunities for future exploitation, and this type of knowledge and competence development is a key driver of VTTs interest in working on ITER.

It was noted in interview that the role of industrial liaison officers (ILOs) is important to the ability of firms and institutions such as VTT to take full advantage of the IP and innovations developed as part of working for ITER. The difference in impact between Finland and Sweden was highlighted, with a more generously resourced approach in Sweden in the last years leading to greater involvement and success of its domestic industry in ITER contracting.

Networking and synergies

VTTs work on fusion energy involves close cooperation with universities like Aalto university, University of Helsinki and Tampere university of technology (TUT) with which there are close physical proximity and a long-standing relationship. Since working on the ITER projects the range of firms that VTT has worked with has increased as they have joined larger international consortia. This type of working has expanded VTTs network with companies in Germany, Spain, Italy and the UK. VTT see this expansion of partnerships and network as one of the main reasons for, and benefits of, being active in ITER.

VTT noted that they have similar experiences, for example in the possibilities to create IP, from working on other Big Science projects such as CERN, and which provided similar benefits 10 years previously. There can be good synergies for organisations such as VTT from working on these projects as they often have similar set-ups. VTT see the Big Science market as a larger international high-end type service opportunity area for universities, research institutes as well as industry, small or large, and which will create synergies that ITER can benefit from.

Conclusion

This case shows how technology institutes such as VTT have a key role to play in the development of the advanced technologies necessary for ITER. It highlights that this is creating multiple new business opportunities for the institute across multiple sectors that it is already active in. This type of work requires good international networks and cooperation with leading universities. VTT acknowledges the benefits of carrying out F4E contracts for ITER, placing particular value on the new markets, partnerships and competences that can be developed in doing so. It is able to provide examples of specific technologies already finding applications outside of fusion energy and which are delivering significant returns. The impact that institutes such as VTT, and perhaps F4E as whole, can have, is enhanced when sufficient resources are allocated to actively working with industry, for example through industrial liaison officers.