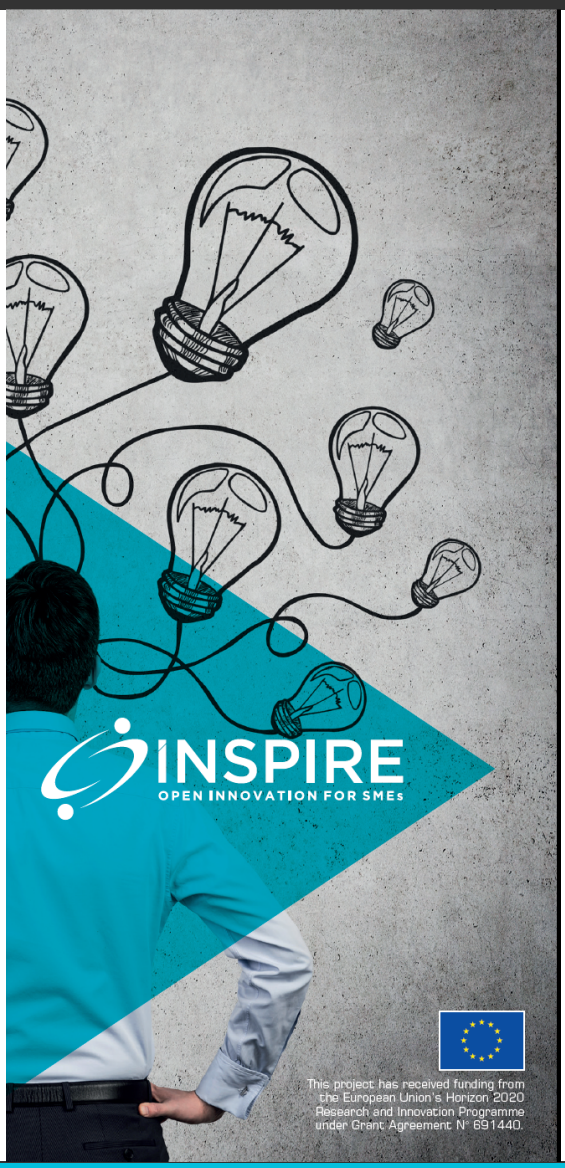

PHYSIP

France, www.physip.fi

Thanks to funding from two national ministries, a research- based spin-off worked with academic institutes and clinical centres to validate and adapt its revolutionary sleep analysis technology and to fine-tune its services to fit potential customers' real needs

Executive Summary

Physip was founded in 2002 as a spin-off from Paris Tech, an engineering school based in Paris specialized in telecommunications. The company specializes in sleep and vigilance analysis using brain activity measured with electroencephalography (EEG). Physip provides researchers, clinicians and industrial R&D services with a range of innovative software and automated monitoring solutions for sleep analysis, sleep pressure measurement and risk of impaired performance. During its development phase, from 2008 to 2015, the company worked on providing services on EEG sleep data in collaboration with a number of French and international universities, clinical centres and institutes. It also received support from the French Ministry of Higher Education for its R&D activities.

CASE N°: FG35

SECTOR: MANUFACTURING

TECH INTENSITY: HIGH-TECH

LIFE CYCLE STAGE: START-UP

INNOVATION VECTORS: PRODUCT, PROCESS, SERVICE

OI PARTNERS: PSR, LARGE CORPORATION, INDIVIDUAL EXPERTS, GOVERNMENT

KEYWORDS: Sleep and vigilance analysis, EEG, algorithms, partnerships with universities, trade secrets, technology transfer, software, service-based model, service providers

PHYSIP

BACKGROUND

The SME developed out of the PhD thesis of one of the founders of the company, which focused on modelling EEG sleep rhythms. The PhD was completed at the Telecom Paris Tech Signal and Image Processing Department, under the supervision of Jacques Prado and Dr. Odile Benoit, one of the pioneers of sleep research in France. The purpose of the research was how to automate the analysis of EEG signals so that the analysis could be done automatically instead of manually. Later, Physip was formed to transfer the proof of concept to real-life applications.

The company raised private funding in 2011 and 2014. Since 2014, the company has also developed business service activities with industrial R&D partners including Airbus, Airbus Helicopters, Thales Training and Simulation, etc. Physip wishes to keep its main core activity as a service provider and is concerned about the protection of its intellectual property. Instead of offering IP arrangements with its partners, the company's strategy is to grow its service-based model by developing new high added-value services and increasing the number of service-based collaborations with larger clients and partners.

INNOVATION CHALLENGE & MARKET OPPORTUNITIES

The ASEEGA® analysis technology, which is at the heart of the Physip project, is the result of the doctoral thesis work by Christian Berthomier on the modelling of EEG sleep rhythms. The ASEEGA® software is operated as Software as a Service (SaaS). After the data is uploaded, Physip performs the analysis and sends the results back. In order to develop the technology for making real-life applications rather than laboratory applications, Physip initially started to collaborate mainly with academic institutes.

Algorithms were developed to analyze complex data, e.g. data recorded in hospital environments. In the meantime, Physip has developed its expertise in analyzing EEG sleep data with French and international clients. At the same time, Physip continued to pursue internal R&D by adapting the technology to the automatic and real-time detection of drowsiness, and then to the identification of cerebral performance markers.

The strategic triggers of innovation at Physip include:

- Collaborations with clinical teams were crucial to validate and adapt the company's technology and trigger innovation to develop new services that meet the real needs of potential clients.
- The financial support from the French Ministry of Higher Education and the private funding received in 2011 and 2014 helped the company to keep complete control of its intellectual property while focusing on potential new innovative developments aimed at maturing the technology and making it ready for real-life applications.
- Collaborations with industrial partners bring added value and trigger innovative solutions that offer potential to develop new products and business opportunities.

The technology is unique and there is no similar offering on the market. This gives Physip an edge in the market in terms of offering advanced technological solutions for sleep analysis, sleep pressure measurement and risk of impaired performance – for example monitoring vigilance and concentration levels of pilots and identifying potential risk points due to drowsiness.

The technology provides automated analysis that cuts down costs significantly and makes it possible to monitor precisely sleep disturbances. The algorithm has the potential to be customized to offer highly valuable real-life applications for industrial partners and it also offers great potential to provide new products and services for everyday clinical practice.

Physip makes regular publications in leading academic journals and is involved in various projects with large companies and government agencies. Physip is also involved in various business service activities through industrial R&D in the field of human factor and operator monitoring; partners including Airbus, Airbus Helicopters, Thales Training and Simulation, etc.

OPEN INNOVATION TRAJECTORY

Concept development

The creation of Physip is based on ASEEGA® analysis technology. In order to attain more real-life applications, Physip started to collaborate during its early stages with academic institutes and

clinical centres. With the collaboration of research institutes and also with support from the French Ministry of Defence, Physip developed the technology to make vigilance EEG with algorithms aiming at analyzing drowsiness, sleep pressure and performance. The concept to be developed was an advanced algorithm that enabled the automated analysis of physiological data obtained from patients during sleep and vigilance.

The company's technology is based on a unique algorithm that collects, records and analyzes real-time clinical data to gain deeper insights into the study and monitoring of sleep and vigilance. The technology provides unique features and functionalities that offer sleep analysis solutions, including web-based sleep analysis aid tools, sleep disorder screening, sleep scoring aid, and sleep monitoring software, among others.

The development process, IPR and competition strategy

Physip developed its expertise in analyzing EEG sleep data with French and international clients, including INSERM, the CNRS, the Giga-CRC (Belgium), the UPK (Switzerland), VivoNoetics (USA), Concordia University (Canada), etc. Over 500 PSG recordings were analyzed in fundamental research studies. Academic and clinical partners were involved in the development process as data source providers to help in the validation phase of the technology and test the algorithm's performance capacity to solve their real needs. No co-development was involved in this process.

At the same time, Physip continued to pursue internal R&D by adapting the technology to the automatic and real-time detection of drowsiness, and then to the identification of cerebral performance markers. In the early stages of the company, Physip collaborated regularly with clinical partners to develop or improve the algorithm. This was very important because they needed to make sure that their services was efficient and to make sure that it met the needs of potential clients.

Physip receives support from the French Ministry of Defence, which proved to be crucial because being supported by the Ministry means that the company keeps all the essential IP. The situation is different when it works with potential customers, such as Airbus and other big names, because generally these large corporations become the owner of the IP which was developed during the project. Their choice to work with government was sub-optimal from a financial point of view because public funding never meets all the needs of the project. On the other hand, it meant that Physip could keep complete control of their IP.

The core IP is not patented because it is very difficult to patent algorithms. However, Physip does protect its technology through trade secrets. The company is considering changing this strategy precisely because if it considers technology transfer with major key clients then it is probably going to be useful to have patents to protect their technology; even if it is tricky to get a patent on algorithms, it is still possible. Physip has therefore not discounted the idea of going in that direction to be in a stronger position in discussions with major clients.

Physip is the only company with this specific knowledge of an EEG algorithm and the way in which it has defined the ownership of the results shows that it could probably manage to keep all the IP for itself and only give privileged or limited access to external parties. The company's business strategy is to exploit its algorithm by offering its software solutions as a service. Implementing a service-based business model by developing new high added-value services and products provides added-value while ensuring intellectual property protection. Another strategy that sets Physip apart from the competition is the potential that its algorithm offers for future targeted technology transfer applications with industrial partners.

Physip decided to finance its initial development work only with public funding in order not to compromise its IP. This was a difficult choice for them to make, but they decided to choose the future and not the present, meaning keeping salaries very low in order to put themselves in a good position for subsequent technology transfer negotiations. The sponsorship of the French Ministry of Defence gave the SME a competitive edge by opening doors to potential clients such as Airbus Helicopters.

Commercialization and follow-up

Physip's main activity is as a service provider. Their algorithms work as a Software for a Service. They keep all the software at their premises, get the data, run the analysis and send the results back to the client. Physip wishes to keep this as their main activity, as it also helps in protecting their intellectual property.

During its initial stages, the company worked with clinical and academic partners to test the development of its technology. Within the scale-up phase which Physip is now undergoing, industrial partners are becoming more important since they are beginning to consider products rather than technologies. On the other hand, the SME is resisting working directly with a big service company because they do not feel that it is realistic

given that they want to maintain 100% control of their IP. In this case, Physip prefers to have them as clients instead of R&D partners. Additional funding to scale-up its services and maintain its R&D activity levels has been made possible through national "investment for the future" projects in collaboration with another SME. The company wants to grow its business model and scale-up by offering new products and services to industrial clients. However, they have turned down different opportunities to improve the algorithm (for example via benchmarking platforms) because they did not feel sure about the security of their algorithm.

Physip is in the phase of planning to go into technology transfer agreements for industrial applications. However, the complication is to come up with the most favourable negotiating terms. Being a small firm with limited resources and a lack of managers with negotiation skills or experience, it is difficult to carve out the best financial deal with the stakes being very high in the case of Physip.

In terms of human resources, Physip could benefit from the services of a seasoned manager. The company owns state of the art technology/ algorithms but in order to reap maximum benefits it needs to get involved in large projects and technology transfer agreements. An experienced manager with previous experience of such deals could involve Physip in agreements with huge financial and technical potential.

The company does not appear to have a very clear future marketing strategy. On the one hand, they want to remain a very strong R&D company and do not feel comfortable scaling-up to run a service model in a bigger market. This reticence will limit the company's immediate potential – for example they are aware of the potential of alliances for clinical use of the service, but they do not want to deal with the difficulties of certification, regulation constraints and developing a bigger company to deal with the needs of an expanding business.

BUSINESS IMPACT

Physip has managed to develop algorithms to analyze drowsiness, vigilance and performance. With the support of various collaborations, Physip is also able to provide the analysis modules, offering a complete portfolio of services and expertise dedicated to EEG recording and analysis.

Physip has learned to identify new market opportunities and collaboration partners. The company has also learned about other open innovation practices and is now looking at technology transfer. It managed to collaborate with a number of partners while keeping the core IP to themselves.

The algorithms provide Physip with a sound position to enter into negotiations for further projects and technology transfer opportunities. The company has developed its business model based mostly on academic partnerships and its income is limited. Physip is now in the stage of pursuing new industrial clients to help the company scale up and turn it into a more profitable business.

LESSONS LEARNED

This case demonstrates how academic research can be developed into successful real-life applications. It also shows that academic partnerships are important to stay up-to-date with the latest developments in the field. Links with government agencies are essential not only for funding but they also help an SME retain its IP which otherwise it might have to forfeit in a project with larger industrial players.

Open innovation plays a crucial role in every phase of this firm's life cycle; from concept to development and also from development to commercialization. Collaboration with academics and the Ministry of Defence proved to be instrumental in developing the idea into a real product. However, unwillingness to open up its innovation to collaborate with bigger players or end users will ultimately determine the trajectory of the company.

Main lessons learned:

1. PSR and individual experts can play a critical role in conceiving and developing innovative technology.
2. Technology transfer mechanisms and deals require experienced negotiation skills which are crucial for exploiting the maximum economic potential.
3. Collaboration agreements require careful deliberation and due diligence.
4. Collaboration with the government sector can be very beneficial for a small company.