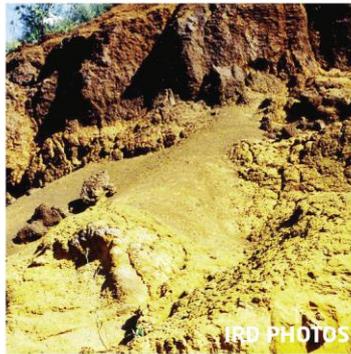
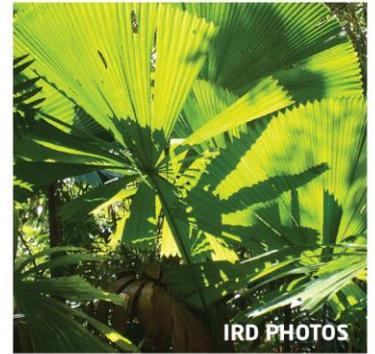


CASE STUDIES ON INDUSTRIAL INNOVATION IN THE PACIFIC ISLANDS



Sociedade Portuguesa de Inovação

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PACE-Net Plus

Pacific Europe Network for Science, Technology and Innovation

The research and innovation landscape of the Pacific is extremely diverse, ranging from Pacific Island Countries and Territories (PICTs) with limited Science, Technology & Innovation (ST&I) capacity, Overseas Countries and Territories (OCTs) with strong capacities, to New Zealand and Australia, which have numerous networks of research and innovation institutions. The European Union (EU), which maintains a long standing relationship with the Pacific, aims for enhancing its profile and reinforcing cooperation in ST&I with the region, in the perspective of the forthcoming Horizon 2020 programme, and promote the development of mutually beneficial partnerships.

Considering the results of past and ongoing initiatives supporting the EU-Pacific ST&I cooperation, PACE-Net Plus aims to support the EU-Pacific policy dialogue in ST&I, including dialogue on innovation issues. It plans to reinforce the EU-Pacific ST&I cooperation, focusing on 3 major societal challenges which are:

1. Health, demographic change and well-being
2. Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the bioeconomy
3. Climate action, environment, resource efficiency and raw materials.

It also aims to encourage the coordination between the EU and Member States ST&I programmes and policies targeting the Pacific by promoting the implementation of joint actions. It also intends to enhance the cooperation on innovation issues, by helping in bridging the gap between public and private sectors. The project expects to promote the idea of innovation as an essential mean for tackling global challenges and will respond to the objectives of the Europe 2020 strategy and its Innovation Union Flagship initiative. Last but not the least, it proposes to strengthen the Pacific-EU research cooperation partnerships, through the promotion of EC's, Member States' and Associated Countries' programmes, especially Horizon 2020, among the Pacific research community, as well as the Pacific opportunities for European researchers.

Case Study Booklet

This case study booklet has been developed with the intention to showcase innovation potential exhibited by the researched organisations during the course of the PACE-NET Plus project. Through this case study booklet, it is intended to present the diversity of the Pacific Region in terms of organisational diversity, innovation as well as the impact created by each of the studied organisations.

The case studies are part of the Work Package 4: Enhancing the cooperation on innovation issues to tackle the societal challenges. The purpose of the case studies are to identify the specific scientific and technological domains and competencies developed by the Pacific region, distinguishing the generic and specific knowledge and skill requirements of each case, the role of different actors and of public policy in advancing innovation as well as the contribution made by EU technology transfer.

The case studies account for local context – and are developed using a combination of primary data collected through interviews and secondary information gathered through extensive literature review.

Selected Organisations

To identify organisations to be studied, some selection criteria were formulated including for instance: has the company filed any patent; is the company launching new product/service within the next 6-12 months; does the company have its own R&D team; has the company experienced continuous growth over the past 3 years; has the company's innovation been successful; etc. To reflect the diversity and innovation capacity, the following organisations have been carefully chosen to mirror their unique attributes:

1. BLUECHAM SAS (New Caledonia), a cloud computing company
2. Nature's Way Cooperative (Fiji Islands), a food storage cooperative
3. Serei No Nengone (New Caledonia), a distillery
4. Vale (New Caledonia), a mining multinational from Brazil with a big operation base in New Caledonia.

We would like to sincerely thank all the companies and their representatives for their effort and time in interacting with us and giving us valuable insights about their organization. We would also like to thank IRD (Institut de recherche pour le développement) and representatives from IRD, in particular, Professor Jean-François Marini (PACE-Net Plus Project Coordinator) as well as Ms. Fadhila Le Meur (PACE-Net Plus Project Manager) for helping us in identifying and selecting companies to be case studied from New Caledonia. Last but not the least, we would like to express our gratitude to the University of the South Pacific (USP) and representatives from USP, especially Dr. Bibhya Sharma, Dr. Jito Vanualailai and Mr. Sheikh Azid for helping us liaise with the company selected for the case study from Fiji.

Bluecham

Bluecham (<http://www.bluecham.net>) is a cloud computing company from New Caledonia whose products are satellite imaging for its clients from a broad range of industries. It is an award winning company which recently received "AWARD 2015 for Technical Excellence" delivered by the Spatial Industries Business Association (SIBA) among many others. The rewarded product has been Qëhnelö™ which provides geospatial cloud computing system. Through satellite imaging at lower cost, satellite data is now available to a broader audience, which otherwise, would have cost a fortune to acquire. Bluecham's software products enable its clients to create value for their respective businesses, whether it is a private mining company or a public sector institution. Bluecham's innovation lies in converting scientific knowledge into business tools used to improve sustainable development.

Nature's Way Cooperative

Nature's Way Cooperative is a thriving Fiji-based agribusiness which provides packaging, marketing and technical services to farmers. The company started its operations by handling only 30 tonnes of papaya annually and has grown now to treat and pack about 1,200 tonnes of papaya, mango, breadfruit and eggplant per year. NWC has had a positive impact in its local community, helping farmers to increase their sales and expand their sources of income, even in times of steep decline in the sugar industry. Similarly, NWC's activities in the expanding fruit and vegetable industry are helping new exporters to develop their businesses. Established exporters have also been helped, and new plantations planned. It has invested heavily in its quarantine treatment capacity for fresh produce over a five year period. The support from the Fiji government has been essential for driving this investment, in addition to financial assistance from private organisations. It has successfully implemented and maintained treatments based on high temperature forced air (HTFA) techniques. This provides a significant advantage compared to traditional methods and has been successful where others in the region have not. At its core, Nature's Way Cooperative specialises in quarantine treatment.

Serei No Nengone

Serei No Nengone (SNN) is a distillery company based in Maré, New Caledonia. The company started out as a collaboration between Mr. Jean Waikedre and Robertet Group to capitalize on the opportunity in the market to develop essence for resale in the international market. The perfume industry being a large global market has contributed to the fast-growth of SNN and has also facilitated its ease to market access through the collaboration with Robertet group. SNN spearheads local

community development by being an inspiration through its innovative process to produce essence at a faster rate while maintaining high quality of the end product. In addition, it contributes to the protection of the environment on two fold – reforestation to ensure sustainability and by being an energy/water saving company.

Vale

Vale (<http://www.vale.nc/>) is a multinational company originating from Brazil with locations all over the world. It has a strong presence in New Caledonia, whereby one of the largest nickel deposits can be found. Although it has multiple businesses, Vale remains a major global mining company and New Caledonia is one of its important markets. Through its presence in New Caledonia, Vale had the opportunity to conduct business as well as improve its societal & environmental footprints. The company provides jobs to about 3000 people in the country, contributing indirectly to the economic development. From an environmental point of view, Vale needs to respect and ensure sustainable mining. Furthermore, the company maintains nurseries to ensure reforestation, and aligns school trips to such endeavors in order to educate the younger generation in New Caledonia. Globally, it appears that Vale is trying to ensure that it is contributing positively on both environmental and societal aspects. Given the size of the company, the innovation chosen has been around the transportation of ores from one place to another by the Valemax ship. Valemax ship offers higher cargo capacity and considerably better port maneuvering capability, thus providing a competitive edge over its competitors.



Case Study on Industrial Innovation in the Pacific Islands Bluecham, New Caledonia

Work Package 4

Sociedade Portuguesa de Inovação - SPI

**Pacific-Europe Network
For Science, Technology and Innovation**



PACE-Net Plus is a project funded by the European Commission to reinforce EU-Pacific cooperation on Science, Technology & Innovation, and to promote the development of mutually beneficial partnerships. Grant Agreement no.: 609490

Executive Summary

Bluecham is a cloud computing company from New Caledonia whose products are satellite imaging for its clients from a broad range of industries. Being a research driven company, it roughly spends 50% of its expenditure on R&D for a continuous product improvement.

This case study aims to highlight the scientific and/or technological domains and competencies implemented by Bluecham, distinguishing between the role of different actors and of public policy in advancing its innovations, as well as the contribution made by EU technology transfer. The case study accounts for the local context – and is developed using a combination of primary data collected through interviews and secondary data through desk research.

Bluecham is an award winning company which recently received "AWARD 2015 for Technical Excellence" delivered by the Spatial Industries Business Association (SIBA) among many others. The rewarded product has been *Qéhnelö*TM which provides geospatial cloud computing system. Through satellite imaging at low cost, satellite data is now available to a broad audience, which otherwise, would have cost a fortune to acquire.

Bluecham's software products enable its clients to create value for their respective businesses, whether it is a private mining company or a public sector institution. Having proven product-market fit, Bluecham has now the challenge of scaling up its business beyond New Caledonia and within the fragmented regions of the Pacific Islands.

Bluecham's innovation lies in its image rendering capability which is 20x faster than other available software solutions, with precision of less than 50 cm. These 2 factors represent a cut throat difference in data analysis processing speed. Being on the "cloud", the software solutions are used anywhere & anytime as long as internet is available.

Fact Figures

Business: Software technologies

Number of employees: 7

Turnover: Undisclosed

Target market in Pacific Islands: Global.

About Bluecham

Introduction to Bluecham



About Bluecham

Bluecham is a young and innovative company from New Caledonia and originally spun-off from Institut de Recherche pour le Développement (IRD). It was awarded the 1st prize of the national competition Osea-Innovation in 2007. Moreover, the organisation is a certified partner of DIGITALGLOBE, the world leader for very high resolution (VHR) satellite imaging.

Since its inception, Bluecham has been instrumental in providing access to several satellite related technological information to the maritime community. Since then, Bluecham has also contributed to a broader range of organisations ranging from mining to maritime industry.

Through its strong research and development background (over 50% of its annual expense go to R&D) and with solid partnerships in the space sector (Centre national d'études spatiales (CNES), European Space Agency (ESA), National Aeronautics and Space Administration (NASA) among others), Bluecham has developed its first technology, named Qëhnelö™ (which mean "Entry Gate" in Drehu). This technology allows the utilization of space data on the "cloud" with easy access as long as internet and a web browser is available. Qëhnelö™ system provides all these information in streaming using only a web browser and a virtual office in the cloud called "Environmental Geospatial Cloud Computing". It means that the system is reachable from everywhere subject to internet access/availability.

Dr. Didier Lille, the Chief Executive Officer of Bluecham, has been the main contact point for the case study.



Source: Bluecham¹

¹<http://www.bluecham.net/> (All the photos used in the Bluecham case study are sourced from its official website.)

Innovation	<p>Spatial and temporal analysis technology is efficient and at times revolutionary. Earth observation satellites now provide the bulk of geographic data. The issue is no longer to know whether this technology exists but rather how to apply it in dealing with the challenges of sustainable development. Bluecham is working to make this technology easily available and economically beneficial: that is the real innovation. This approach provides its clients with new resources, new information, and new tools to support consultations and deliver irrefutable proof. This allows its clients the liberty to not be a specialist to use it but simply know their own business and have access to a web browser. Elected officials, customary law specialists, technicians, water suppliers, fire brigades, industrial companies and scientists regularly use these customised applications.</p>
Process and Usage	<p>Remote sensing data is one of the most powerful information providers during a crisis whether natural, industrial or human. Satellites can now take images every day with a resolution reaching 30 cm on the ground via the SEPSAT™. Leveraging on its strength, the company has then paid attention to issues affecting tropical areas, the state of coral reefs, mangroves surveillance, study of the maritime traffic in the lagoon among others. The potential of the technology expands its reach to open sea surveillance, using satellite to measure the colour of sea water (to detect the presence of phytoplankton for example), or to measure the temperature at the surface of sea water (having a direct correlation with pelagic or school of fishes).</p>
Clients	<p>Bluecham's major clients are from the mining industry, maritime industry, public sector, and research sector. These clients need to have regular high-precision monitoring of their work, inventory and impact. On the other hand, the technology is also accessible to a broader range of SMEs which could not afford such information before.</p>
Awards	<p>In 2014, the DigitalGlobe space agency awarded Bluecham with an "Excellence Award for Asia-Pacific" and an "Innovation Award for Asia-Pacific". The most recent award was in 2015 for "Technical Excellence" by the Spatial Industries Business Association.</p>
Basic Financial	<p>An undisclosed key information regarding Bluecham indicates that 50% of its revenue is spent on R&D and development cost is yet to be optimized. Growth is at 20% but it is considered slow. There is an intention to speed up growth by expanding client acquisition within and outside the Pacific region.</p>

Focus on Industrial Innovation

Rationale behind innovation

In a nutshell, satellite information provides 80% of the data regarding Earth's geography according to Bluecham. Being able to put such huge amount of data in the hands of more people has been a key reason to innovate for Bluecham.

Innovation leads to opportunities

The Pacific region is one of the main regions where global warming is affecting its fauna and flora. The region, in particular, the tropical zones are vulnerable. Governments and other organisations require new tools which are better and affordable to keep them informed with accuracy to analyse, anticipate and act. For instance, Mr. Didier Lille shared that one of the product, the HUB Qëhnelö, which was set up within 4 hours in Vanuatu during the cyclone PAM in March 2015 (with gusts of 350km/h) has demonstrated that it is possible to collect satellite information in real time to assist rescue teams.

Challenges faced while innovating

For Bluecham, the challenge started out with a better understanding on the business since the team is composed of researchers, according to Mr. Didier Lille. Moreover, the challenges were also to build a high performing team in that particular region of the world, and motivate the team to work on the scientific and technological challenges. He further added that the fact that the "typical client" used to purchase data when it comes to geographical data, Bluecham had to educate the client. Now they sell their software services to the same client, who used to simply purchase data from third party providers.

Services and Products

Bluecham's industrial innovation has resulted in the two distinct services and products that it has brought in the market - Qëhnelö™ and SEPSAT™.

Qëhnelö™

Qëhnelö™ is a web-based decision-aid hub for urban planning and environmental management. Qëhnelö™ is the new geospatial technology operating in the cloud. Its modular architecture means it can be tailored to clients' needs. Qëhnelö™ is the first system that provides clients with the power of Earth observation satellites on a turnkey basis. No installation or maintenance is required. A Qëhnelö™ hub is a set of applications (or software/modules) to which a client can have secure access via the web. These applications use online resources (geographic and bibliographic databases, directories and mathematical models) and provide high value added services (fast mapping, territorial analysis, environmental tracking, forecasting and impact studies). Innovative features of Qëhnelö™ are

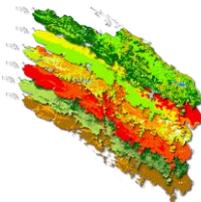
Case study: **Bluecham**



Simple and accessible as a browser: It is intuitive to use and the applications are ergonomic because of the particular attention paid to its design. Clients do not have to install anything or provide any maintenance. They also have regular and automatic software updates and are useable anywhere at any time.



Added value of satellites: Qëhnelö™ provides effortless access to space technology and to SEPSAT™ products. This makes it easy to track landscapes and anticipate risks. It also possesses innovative characteristics like: reproducible in time, analytical quality, rigorous quality control and the most cost-effective technology down to a scale of 1:2000.



Searchable option for data needed: Qëhnelö™ is the first system that delivers content as soon as it is installed. This allows access to a vast amount of data that is scattered across the web possible. It also enables to cross-reference this data with clients own information to perform analyses. This function is particularly valuable as data is extremely expensive.



Access mathematical models: Qëhnelö™ connects to remote calculation models. In this way, a client can benefit from resources that until now were only accessible to research laboratories, such as simulation models for erosion, vegetation tracking, risk evaluation and natural phenomena.



Dual security: The system is separate from the databases: whether a client uses Qëhnelö™ or not, the databases are permanent and remain clients property. Qëhnelö™ provides additional services and also the possibility of accessing data other than clients own. Data flows and the confidentiality of exchanges are also guaranteed.



Cost-effectiveness: The service provided is immediately cost-effective. It saves specialist personnel time by outsourcing all IT requirements. The data produced is systematically capitalised in the platforms. Satellite acquisition is profitable as paying twice for the same data is no longer required.

SEPSAT™

SUIVI ENVIRONNEMENTAL DE PRECISION PAR SATELLITES

Given the economic growth and new environmental challenges, it is now more than ever necessary to have the right data to hand at the right moment. There is a growing number of new, increasingly precise observation satellites. SEPSAT™ functions for Precision Environmental Tracking by Satellite, and constitutes of a range of high value added products developed by Bluecham. Bluecham together with its scientific partners and space agencies has

developed specific expertise tailored to the issues and needs of the tropical zone. The company has the ability to provide their clients with a comprehensive range of products and geospatial data analysis services tailored to the needs: baselines, impact studies, environmental monitoring, themed products, risk mapping, etc. These products have been scientifically validated, a crucial aspect for compiling reports.



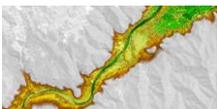
SEPSAT Technology: The innovative features of SEPSAT Technology are: reproducible in time providing the clients with the guarantee of comparable results; reproducible at any site with the guarantee of comparable results; rapid production on request; precise and at the scales specified; and compiled in cooperation with scientists working in the relevant fields.



“Satellite imaging” product range: The innovative features of SATELLITE IMAGING are: most precise tailored imaging as per natural colour, and infrared or super spectral images with a resolution down to 30 cm.



“SEPSAT Thematic” product range: The innovative features of SEPSAT Thematic are: to characterise vegetation cover and its change over time; analyse the impact of sedimentary plumes; and identify soil types and model their change under the effect of erosion.



“SEPSAT Topo” product range: SEPSAT Topo is a range of quality and controlled precision topographical products (ortho-imaging and/digital elevation models) designed to suit client’s needs. It is an innovative turnkey integration of geospatial data into client’s projects.

Cutting Edge Advantage

Recognising the need for a simplified and customised GUI to optimise data analysis processes, Bluecham has worked with Intergraph (which provides enterprise engineering and geospatially powered software to businesses, governments, and organisations around the world.). This effort has resulted in the integration of Intergraph’s ERDAS IMAGINE® Professional and IMAGINE Photogrammetry in Bluecham’s IT environment to tackle slow data analysis workflows as a result of large-sized input imagery. Through the improved IMAGINE spatial modeller, users are able to develop graphical data models. For instance, building a flow chart in a GUI environment to process spatial data is easier than ever. There is no more need for the long and complex modelling scripts, which could take days to get done when it can now be completed within an hour using the GUI environment, or automatically generated by the model

when operated/ run.

It was understood that a major technical change has been made. The migration from IMAGINE spatial modeller language to a user-friendly GUI which relies simply on inputs, outputs and variables. The new system architecture enables on-the-fly dynamic processing, thus allowing Bluecham to visualise output in real time without creating a new dataset. Two immediate consequences observed were considerable saving of processing time and disk space during model creation as well as saving of editing. Furthermore, Bluecham is optimising its time and resources by reusing data models, and through a library of data models to use the same models with different data from a variety of sensors from different years.

Satellite imagery is ortho-rectified or calibrated using IMAGINE Photogrammetry, then mosaicked and colour balanced for change detection studies and vegetation mapping. Orthorectification in ERDAS IMAGINE has proven to be 20 times faster than other remote sensing software packages. Processing any remote sensing data types can be done very quickly. In addition, Bluecham has been able to achieve X, Y, and Z accuracy to less than 50 centimetres. For example, processing 50 GB of Worldview-2 data 10 times faster than with any previous data processing chain. There is also an increase in the accuracy of geographical location from 1.5 m to less than 50 cm.

Impact

General

Bluecham, as a company, develops the technology which enables its clients to have an impact within their businesses, whether the impact is economic, social, societal or environmental. In order to do so, an analysis of three clients listed on Bluecham's website has been made to better understand where the potential impact lies on.

VALE is a Brazilian multinational diversified metals and mining company and one of the largest logistics operators in Brazil. It also operates in New Caledonia.

- CNRT Nickel is a mining cluster in New Caledonia that started out in 2007 with the aim to work on the overall sustainable development of the environment and extraction of Nickel in the country, which according to

estimates, is home to 20% of the world reserve.

- SMSP New Caledonia is a metals and mining corporation, based in New Caledonia with partnerships with Xstrata (Swiss company) and POSCO (South Korean company). The main activities are nickel mining and metallurgy.

Given the similarities of the three organisations listed above, it is understood that Bluecham’s SEPSAT is increasingly needed for the following activities:

- To make use of satellite to monitor the environment
- To deliver impactful studies of the named clients on the environment
- To provide a baseline for the named clients to understand and explore any given mining area
- To provide reports on the risks associated with particularly zones, especially mining areas.

Environment

When it comes to environmental impact, the solutions provided by Bluecham enable all stakeholders to be given access to the latest information. The latter can be seen as an enabler to facilitate the communication of relevant information between the population, the local administration (public sector officials and organisations), the industrials and the scientific community. With such solid information, discussions on the actions to take become concrete and “facts” are easily presented, and there is a minimization of people’s subjectivity on decision making. As an example, Bluecham monitors and classifies mangroves for city planning and mining companies in New Caledonia. Mangroves play an important role in the environmental ecosystem, affecting fish. Moreover, mangroves forests are classified as a natural heritage and are faced with hazards ranging from cyclones to tsunamis that can greatly affect the fragile ecosystem.

Economic

By making use of Bluecham’s software solutions, the client can operate on a global scale (i.e. where the satellite is covering at any given point in time). Indirectly, the economic gain is numerous although it can’t be readily associated with profitability:

- Monetization and re-utilization of existing information collected

- Centralization of costs in terms of data acquisition (in other words, it can be cost-saving)
- Real time access to natural events (e.g. natural calamities/phenomena)
- Time saving for concerned actors (e.g. mining company can save time by knowing exactly where to proceed).

Since the solutions provided are hosted on the “cloud”, the client is paying for what it is using, which makes the offer even more financial attractive. It also benefits in terms of reduction of IT maintenance cost.

Societal

Satellites monitoring the Earth are the ones providing the large majority of information regarding the environment. It is a paradox, given that this information is the most efficient and the cheapest on the market. On the other hand, the access to such valuable information is limited and often, the information is under the control of a couple of closed organisations. Bluecham’s technology allows a broader range of organisations across multiple industries to access similar information simply through internet connection. Whether private or public sector entities, they are able to access such information that can help to influence businesses but also decision making when it comes to sustainable development. For instance, local authorities in the Pacific Islands can make use of such technology to monitor global warming effect in the environment at more affordable rate.

Success Factors

Satellite as a niche

It is observed that Bluecham’s main asset is the technology enabling satellite communication at a low cost, while rendering the most accurate set of data (currently) available. This is an essential tool for the work carried on by major clients either for their mining exploration or research or environment. For instance, Satellite can, therefore, be an asset for the sustainable management of resources by the local fishing industry and the local authorities. In the event of natural phenomena, satellite usage can be useful and allowing both the detection and follow up turbidity currents in the lagoon, which usually would cover the corals and, then go all the way up to the basins where there is a source of sedimentary rocks. This information is essential in order to prioritize

Case study: *Bluecham*

Location & Economy

mining sites and minimize future impacts.

New Caledonia is estimated to be home to 40% of the world's known nickel deposits. In addition, the country is rich in biodiversity but is under threats from forest fires and mining exploitation. Therefore, Bluecham's technology is rightfully needed to contribute to curve the threats – by benefitting to mining companies, local authorities, SMEs and other environmental monitoring groups.

The “Cloud” Advantage

This factor is essential on an archipelago where mobility is required and reliance on wireless networks represents the most suitable way to keep a line of communication. In the context of Bluecham's technology, the company/is able to monetize each service but also to keep the cost low by having one centralised software that multiple clients can access.



Case Study on Industrial Innovation in the Pacific Islands Nature's Way Cooperative, Fiji

Work Package 4

Sociedade Portuguesa de Inovação - SPI

Pacific-Europe Network For Science, Technology and Innovation



PACE-Net Plus is a project funded by the European Commission to reinforce EU-Pacific cooperation on Science, Technology & Innovation, and to promote the development of mutually beneficial partnerships. Grant Agreement no.: 609490

Executive Summary

Nature's Way Cooperative (NWC) is a thriving Fiji-based agribusiness which provides packaging, marketing and technical services to farmers. The company started their operations by handling only 30 tonnes of papaya annually and has grown now to treat and pack about 1,200 tonnes of papaya, mango, breadfruit and eggplant per year.

This case study aims to highlight the scientific and technological domains and competencies implemented by NWC, distinguishing between the role of different actors and of public policy in advancing its innovations, as well as the contribution made by EU technology transfer. The case study accounts for the local context – and is developed using a combination of primary data collected through interviews and secondary data collected through desk research.

It is found that NWC has had a positive impact in its local community, helping farmers to increase their sales and expand their sources of income, even in times of steep decline in the sugar industry. Similarly, NWC's activities in the expanding fruit and vegetable industry are helping new exporters to develop their businesses. Established exporters have also been helped, and new plantations planned.

NWC has invested heavily in its quarantine treatment capacity for fresh produce over a five year period. The support from the Fiji government has been essential for driving this investment, in addition to financial assistance from private organisations. Working directly with the farmers, NWC tries to ensure that the product quality consistently meets the required export standards. With good management in place, NWC interactions with the stakeholders have been well-maintained and contributed to its growth.

NWC has successfully implemented and maintained treatments based on high temperature forced air (HTFA) techniques. This provides a significant advantage compared to traditional methods. At its core, NWC specialises in quarantine treatment. Moreover, NWC's relevance to the country has been increased through playing a role of facilitator in the ecosystem. Thus, through a focus on innovation, and good management, NWC has managed to grow and generate revenue that helps it to minimize reliance on external sources of funding.

Nature's Way Cooperative (NWC) Overview

Sector: Quarantine treatment

Number of employees: Over 30

Turnover: Around 296,000 Euros for 2015

Target market: Pacific Islands.

About Nature's Way Cooperative (NWC)

Introduction to NWC



Nature's Way Cooperative (Fiji) Ltd was established in 1995. Its main focus is to provide quarantine treatments for Fijian fruit and vegetables under the Bilateral Quarantine Agreement (BQA)².

NWC has become a thriving agri-business - providing packaging, marketing and technical services to exporters and farmers. Initially a small enterprise handling just 30 tonnes of papaya each year, NWC now treats and packs about 1,300 tonnes of papaya, mango, breadfruit and eggplant annually.

Mr Michael Finau Brown (Michael Brown) is the Chief Executive Officer and has been the main contact point for the case study.

About NWC

NWC is a cooperative owned and operated by the Fiji export industry stakeholders focused on the four aforementioned BQA commodities. NWC's stakeholder system shows its inclusive strategic model and the value it places on its interactions with key players in the agricultural value chain for exports. NWC stakeholders and member system includes Farmers, Exporters, Government, BAF (The Biosecurity Authority of Fiji), donor agencies and employees.

Focus on HTFA

NWC's activities revolve around the treatment of BQA commodities before shipment for export using the High Temperature Forced Air (HTFA) technology. Exporters, who are also members of NWC, pay the organisation a treatment fee calculated on a per kilogram basis.

Economically-set fee rates

Quarantine treatment fees have been set at an economic rate from the outset - enabling the NWC to meet operating costs, fund repairs and maintenance, invest in expansion and make "rainy day" provisions for events such as cyclones and trade disputes. The exporters buy their products from other NWC cooperative members (farmers), enabling these farmers to focus on growing the BQA commodities.

NWC now operates an HTFA treatment facility in Fiji with a 3,000 tonnes capacity. The fees it receives for the use of this facility are its main source of revenue. The below table is an indication of NWCs revenue.

²A bilateral quarantine agreement is often required when trade negotiations are undertaken between countries for commodities of plant and animal origin that may harbour pests and diseases harmful to the importing country.

Case study: *Nature's Way Cooperative*

Table 1: NWC's Annual Revenue

2008	2009	2010	2011	2012	2013	2014	2015
\$ 853,212	\$ 896,505	\$ 358,227	\$ 757,684	\$ 634,209	\$ 425,272	\$ 566,301	\$ 694,046

**NWC's
Operational
Activities**



Source: Ministry of Industry and Trade³

**International
market impact**

NWC's revenues are impacted by international market demand and the availability of fruit for exports. NWC believes that it is imperative to address issues affecting the supply of fruits for exports through its own extension programme and those of other institutions that support the Fijian exports industry. Likewise, NWC also aims to increase international market awareness of the quality of Fiji fruits and vegetables through marketing development strategies. To achieve such effort, NWC has to keep up in terms of quality of both the product and the work flow through new methods or improving existing ones.

**Outreach
programme
in Fiji**

In order to increase the size and reach of Fiji's fresh produce industry, NWC introduced a comprehensive outreach programme which it hopes will become a model for similar industries in Fiji and other Pacific Island nations. Aiming to double Fiji's quarantine treatment capacity for fresh produce over a five-year period, NWC has invested in infrastructure, systems and equipment. The new

³<http://www.mit.gov.fj/index.php/divisions/department-of-cooperatives-businesses/success-stories/nature-s-way-co-operative>

	<p>facilities of four heat-treatment chambers and the SPC-LRD (IACT)-supported mezzanine floor, a new fruit grading machine and a power generator and handling and grading equipment have increased capacity to 3,000 tonnes per year.</p>
<p>Available outside investment</p>	<p>NZ/AusAID has also provided funding to expand the area of production through a research and extension outreach programme to treat an additional 1,000 tonnes of BQA commodities by 2016.</p>
<p>Public and private sector interactions</p>	<p>NWC interacts in partnership with the public and private sectors, and receives additional funding from domestic and overseas agencies. NWC works with farmers to improve their systems, ensuring their produce is of consistently high quality and meets overseas export standards. In recent years crops have been affected by cyclones and floods, but the industry has managed to rebound. For its part, NWC quickly contributed some (modest) amounts to its members to be used for recovery so that their livelihoods could be sustained.</p>
<p>HFTA Process</p>	<p>The quarantine treatment technology used by NWC (HTFA) was developed in Hawaii as a quarantine treatment for papaya to replace the highly unsatisfactory double dip hot water treatment. The HTFA process involves slowly heating the fruit (5-6 hours) to a temperature that can kill fruit fly larvae and eggs (around 47.2 °C). These HTFA units also have the added bonus of increasing the shelf life of fruit and thereby enhancing marketability. An international patent on the HTFA technology is currently held by a New Zealand based company Quarantine Technologies International (QTI). Commercial HTFA units have the capacity to handle from 250 to 2,000 kg of fruit per treatment run. In the late 1980s, the Cook Islands pioneered the adoption of HTFA technology amongst Pacific Island Countries (PICs) with the export of papaya to New Zealand. Technical and financial assistance was provided by New Zealand. Fiji and Tonga established commercial HTFA units in the mid-1990s, with technical assistance provided by the United States Agency for International Development (USAID). These were followed by commercial units in Vanuatu and New Caledonia. Only the Fiji unit has sufficient throughput to be commercially viable.</p>

Focus on Industrial Innovation

Rationale behind innovation

Mr. Michael Brown shared that the company started to innovate in order to have an effective and efficient work design/process flow, to reduce operational costs and to reduce wastage.

Innovation leads to opportunities

As consequence of innovation, this led to better work quality and labour management according to Mr. Michael Brown.

Challenges faced while innovating

NWC shared that there are three major challenges in implementing the innovation which are i.) The adoption of innovation measures was tough to be implemented, ii.) Lack of buy-in from the staff, given that it was all new concepts to them and iii.) Access to funding has also been a challenge for the organisation.

Supply Chain

Source: FAO⁴



In Fiji, trust is a key factor that enables a successful integration of supply chain. A common and important practice has been to communicate information openly among stakeholders to ensure transparency. This NWC strategy has enabled an increase in competitiveness in the Fiji market, in particular for perishable and delicate processed products.

NWC conducts value chain training and extension officers provide advisory services to members for embracing GAP (Good Agricultural Practices) to realize the quality that is required in the export markets. The trainings also include post-harvest handling techniques, transportation as well as variety trials to select the best produce for export markets. Being able to constantly improve their work flow is essential to keep up with changing landscape.

Facilitator

NWC's role as a facilitator in the market place is important. It has engaged with its stakeholders along the value chain and built rapport among stakeholders (i.e. growers, suppliers, transport agents and exporters). NWC has helped to raise competitiveness within the industry and local market by encouraging farmers to produce more and maintain quality standards while providing incentives to exporters to retain and grow their supply side (i.e. farmers). Furthermore, the demand from the domestic buyers has also increased, so that

⁴<http://www.fao.org/3/a-an427e.pdf>

Core & Services

they now compete with exporters for the produce from local farmers.

The core service of NWC is the quarantine treatment. Other services provided are:

- Importation and supply of seeds to its smaller farmer members
- Small field service; crates for farmers.

Moreover, NWC has implemented the following to provide a better work quality and flow within the organisation:

- Backup Generator – to enhance continuity of quarantine treatment during power blackouts
- Papaya grading machine – grades fruits of various sizes into its categories
- Sea freight bay – increase volume of exports and reduce freight costs in comparison with air freight
- Hot water dip – a treatment for papaya to reduce disease level and improve quality of fruits as received by the importers.

Increasing capacity

As part of its business model, NWC has developed an action plan to better integrate small-farmers into the value chain. Activities have been aimed to:

- Increase threefold the quarantine treatment capacity –increasing export capacity to around 5,000 tons per year
- Create a focused industry outreach program – to facilitate the increase in volume and quality of fruits
- Acquire new equipment – such as field crates for farmers to store their produce before transportation.

By increasing its capacity, NWC took into account the potential challenges (such as natural calamities or competition). The need to progress and the understanding of potential challenges are great motivators to improve the current business.

Continuous

NWC provides training in value chain and research activities, and extension

Case study: *Nature's Way Cooperative*

Improvement officers provide advisory services to members in using GAP (good agricultural practices) to realize the quality that is required in the export markets. The training includes post-harvest handling techniques and transportation, as well as variety testing to select the best produce for export markets.

Brief flow of operations at NWC:

Figure 1 diagrammatically showcases the operational flow of activities that are sequentially followed throughout the production process.

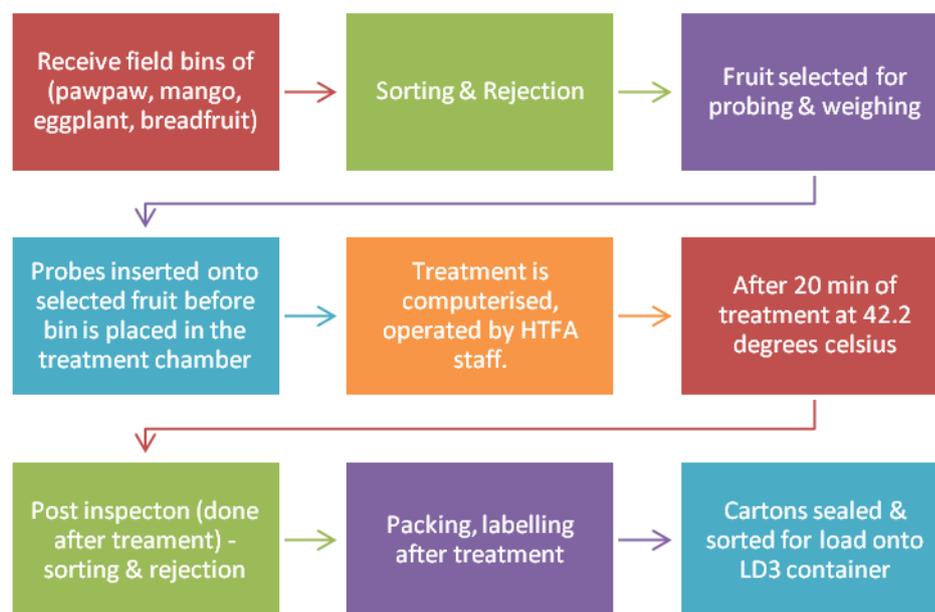


Figure 1- NWC Operations Flow

Impact

Societal & Environmental

The NWC treatment facility does not use any form of chemicals and the complex is Hazard Analysis and Critical Control Points (HACCP) compliant. The international standards followed by NWC include the following:

- SPS (Sanitary and Phytosanitary measures)
- ISPM (International Standard Phytosanitary Measures)
- IPPC (International Plant Protection Convention)

In the interview conducted, NWC identified the organisation's interest to be a

Economic

learning centre for university students to allow them to learn real-world life knowledge, skills and attitudes in addition to the academic preparations they receive. The organisation aims to be known for its contribution to future leaders and entrepreneurs.

The establishment of NWC as a legal entity has strongly contributed to the creation of meaningful impact:

The local industry has benefited from NWC's presence by encouraging higher production volume from small farmers and increasing the overall competitiveness within the industry. The presence of NWC as a marketplace for producers and exporters has provided an indirect quality control system and instilled confidence in consumers that quality products are available. Moreover, through the exportation of products, Fiji gains from a self-promotion on the international markets.

Success Factors

Good Management

Success has often been connected to the top quality managerial work delivered by the Chairman and General Manager who served the organisation from its early conception in 1995 until 2009, which was followed by another experienced General Manager in 2010. Despite NWC being a cooperative and highly accountable to its shareholders, i.e. farmers and exporters among others, the NWC's management has maintained a rigorous control over the key decisions, not allowing too much influence from shareholders and other external components.

Formulating a proper business structure within a cooperative was probably a major contributing factor to NWC's success. By enabling the organisation to generate revenue and therefore, to pay for its own repairs & maintenance, invest in business expansion, and to make provision for the "rainy days", NWC moved towards a sustainable business model. Moreover, it helps the cooperative to live beyond the initial fund and become financially less dependent on other sources of funds. Adding on to the business structure, the good management has been able to focus on driving financial results yielding positive cash flow, through sound business decisions. In this case, the introduction of the eggplant to the product line in 1998 to complement and even surpass papaya was a major factor.

Supportive Environment

It has also been understood that the role of the management has been to mediate between the various stakeholders and to keep them together, and engaged over common goals. Last but not least, as NWC owns and operates the quarantine treatment facility, NWC's management is able to act as marketplace for its shareholders, who are also its customers, thus enabling exporters and growers to interact with transparency and build long-lasting business relationship together.

The deterioration of Fiji's sugar industry has potentially been a major contributing factor to the diversification of agricultural products, i.e. expanding to fruit and vegetable. It is part of the Fiji government national strategy to boost exportations to help organisations directly (and also indirectly) involved with overseas trade. Funding is available for organisations requesting financial assistance: For instance, to upgrade their facilities. NWC has made use of government grand support to improve its operational efficiency by upgrading its facilities.

The Fiji government has played a relatively hands-off role in the success of NWC by being the provider of initial capital and conducting the core quarantine functions needed by the organisation. Following the initial assistance, little interference from the government has proven to be beneficial when combined with the good management (as stated previously). NWC is thus a good example of solid public-private-partnerships in Fiji, and possibly the Pacific regions. Small farmers, who are shareholders and customers of NWC, have also received financial support and technical training & support from the Taiwanese Technical Mission. Micro-finance schemes have enabled these farmers to have a starting capital that was required to be paid back, once they begun harvesting.



Case Study on Industrial Innovation in the Pacific Islands Serei No Nengone, New Caledonia

Work Package 4

Sociedade Portuguesa de Inovação - SPI

**Pacific-Europe Network
For Science, Technology and Innovation**



PACE-Net Plus is a project funded by the European Commission to reinforce EU-Pacific cooperation on Science, Technology & Innovation, and to promote the development of mutually beneficial partnerships. Grant Agreement no.: 609490

Executive Summary

Serei No Nengone (SNN) is a company based in Maré, New Caledonia. The company started out as a collaboration between Mr. Jean Waikedre and Robertet Group to capitalize on the opportunity in the market to develop essence for resale in the international market. The perfume industry being a large global market has contributed to the fast-growth of SNN and has also facilitated its ease to access the market through the collaboration with Robertet group.

This case study aims to highlight the scientific and/or technological domains and competencies implemented by SNN, distinguishing between the role of different actors and of public policy in advancing its innovations. The case study accounts for the local context – and is developed using a combination of primary data collected through interviews and secondary data collected through desk research.

SNN spearheads local community development by being an inspiration through its innovative process, that is, to produce essence at a faster rate while maintaining the high quality of the end product. In addition, it contributes to the protection of the environment on two fold – reforestation to ensure sustainability and by being an energy/water saving company.

While the company is growing well, there are still opportunities for them to further enhance the educational & economic level of the community, and indirectly, to have a positive impact in the business ecosystem. These opportunities are believed to be an essential balance between doing business for profit and giving back to society and the environment.

Fact Figures

Business: Production of essence made from natural products such as sandalwoods.

Number of employees: 26 employees

Turnover: NA

Target market in Pacific Islands: SNN sells directly to industries outside of the Pacific Islands

About Serei No Nengone (SNN)

Introduction to SNN



Serei No Nengone (SNN) is a company based in New Caledonia, precisely in the Island of Maré. The company has developed its own process to extract aromatic fragrance without losing on the quality of the raw material. SNN was started out by Mr. Jean Waikedre, biochemist engineer at l'Institut de Recherche pour le Développement (IRD), originally from the Island of Maré along with Dr. Daniel Joulain, previously Research Director for the group Robertet (world leader in the field of aromatic substances), in natural products for perfumes and flavours. Together, the partnership has developed a mild and highly selective process. Dr. Joulain claims that the product is unique to SNN and is not produced by any other company so far.

Mr. Jean Waikedre, the director of SNN has been the main point of contact for the case study.

SNN's Beginning

Regarding the extraction of the wood essence from Sandalwood, trials were running to improve the productivity and the quality of the product. Significant results were noticed - the extraction process consumed less water, less electricity and emitted zero waste.



Source: SNN

SNN as an organisation is primarily the fruit of a joint collaboration between international and industrial development. The particular characteristics are that SNN relies on the customary environment to grow and develop its core product,

The Business

while contribution to the local environment and then turns to international markets to export its products, leveraging on the world leader of natural products in the aromatic sector. Robertet Group is a shareholder of SNN, a partner in the technological development as well as a client of SNN. The organisation made a good bet by investing and assisting SNN in its development.

Some of the world's leading perfume brands (e.g. Chanel) and cosmetics (e.g. Weleda) source their aroma from SNN. The company is currently preparing an application for the "Forest Stewardship Council" certification to be recognized for its work and in order to hold a standard quality label. Another certification sought has been the ISO 14001 (Environmental Management), which aligns with SNN's work process of zero waste production, renewable energy production to cater for SNN's needs, water collection via greenhouses and optimization of its production process among others.

Basic Financial Info

SNN's team consists of 30 staffs and generated about 2.15 million Euros in revenue in 2014, which is about 40% higher than in 2012. The organisation relies solely on exportation.

Focus on Industrial Innovation

Rationale behind innovation

Mr. Jean Waikedre shared that based on the research and exploitation of business opportunities, SNN has focused on technical, environmental, social and societal innovation.

From the technical reasoning for innovation, SNN has chosen to extract sandalwoods (through a cold process) over the usual process (hydro distillation) in order to achieve its objectives :

- Address the demand from the industry player who needed to arise the quality of the essence produced
- Optimize the extraction of the essence by two to four times while increasing the output quality
- Reduce the environmental impact through a low water & low power consuming machine (Extractor).

Innovation leads to opportunities

Mr. Jean Waikedre continued with the idea that the innovation idea that SNN implemented has been able to open more opportunities such as bringing a new product on the worldwide market for luxurious perfume.

Moreover, environmental and societal innovation has allowed an inclusive participation from the local population in the operation of the sandalwoods plantation as well as the protection of the natural resources.

In addition, this approach has allowed SNN to gain international visibility in the global market for natural aroma. He added that obtaining the Forest Stewardship Council (FSC) is still in progress.

Challenges faced while innovating

The main challenge has been to establish SNN's credibility as a young enterprise whose activities started out in 2010. Launching both the operations and the company itself were connected, and thus, according to Mr. Jean Waikedre, another two additional challenges for innovation implementation in SNN were:

1. Assuring credibility among the financial services, especially, that the company is run outside of Nouméa in the Island of Maré. To this date, no other company is functioning over there besides SNN.
2. Building trust and credibility among the local population and authorities. Their past experiences were rather negative as the Island was used for dumping waste without taking into account the local population's request and without anticipating on the environmental impact.

The Extraction Process

The extraction process is considered innovative because it:

1. Requires less heating temperature
2. Reduces loss of the natural aroma due to chemical degradation occurring during standard steam or hydro-distillation.

The innovation process lies in the creation of a tool adapted to the sandalwood which can also be used for the treatment of other similar materials. The support from the local authorities and local people in innovation:

Initially, there has been no particular law in New Caledonia regarding the industry in which SNN operates. However, a public-private partnership in the form of regulation has been set in place to protect the natural resources in the

Islands, belonging to New Caledonia where SNN is operating. The current regulation is expected to evolve in the future, learning from the lessons of the past few years and taking into account the weaknesses of the existing ones. Furthermore, this agreement has reinforced the application for the Forest Stewardship Council (FSC) Certification.

The need for innovation lies in the multi-stakeholder cooperation and sustainable business development. It was quintessential for SNN to combine its business activities with the local population's needs for a harmonious cohabitation between profit and sustainability.

Impact

Environmental

The organisation uses an innovative industrial process consuming less amount of water, a reduced consumption of electrical energy and near to zero waste emission. In terms of water needs, SNN is self-sufficient by collecting and stocking rainwater. On the other hand, electricity is produced through solar photovoltaic of 100KW placed on the roofs of the factory. Sustainability is ensured through an impressive exercise: for every tree that is cut down, there are almost 30 new trees planted. This is to ensure sustainable development in business and also for the betterment of environment. It is estimated that about 15,000 trees have been replanted annually in the past couple of years.

To further elaborate, SNN is based on the essence that natural resources of the land have to be protected. Another company that works together with SNN is Takone, a buying group of raw materials for the unit of extraction of aromatic essences, the production unit of forest plantations, a tool of economic development for Islands loyalty, an incubator and carrier of new initiatives (e.g. working wood, growing useful plants), and is also a tool of development.

Mr. Jean Waikedre mentioned that there is no river in the Island of Mare, water supply was tricky. The local population relies on wells for fresh water. It was thus a challenge for SNN to make things happen relying solely on rain water. Interestingly, the water tanks started out with 400 m³ capacity which then increased to 600 m³, and most recently, to 2100 m³. Lastly, New Caledonia is one of the rare places on Earth where quality sandalwood can still be obtained. Overexploitation in India has led to the near extinction of the specimen, and SNN has started and has also financed its own Sandalwood nursery in

collaboration with local authorities.



Source: SNN

Societal

The local authority has been involved since the early days of SNN. The authorities take a great interest in what SNN (including TAKONE) are doing, and play a proactive role in the economic management of the particular sector. And, it was noted that a significant increase of income stemming from the aromatic sector was affecting the plantation program and influenced the increase in the purchased price of sandalwood. Furthermore, an implication of local authority takes place in the economic management of the sector, in particular by the creation of the company, TAKONE, where meetings were conducted to collect information and gather the reflections in order to research for solutions to the problems revealed on the ground. Thus affecting the implementation of new initiatives in the Island.

The initial forecast was the creation of 5 jobs. But today, there are 26 jobs (full time permanent contract) and over 200 families benefit indirectly from this sector. In general, the local population benefited from the training and insertion initiatives. A significant part of the initial investment has been realised by craftsmen of the Island of Maré.

Economic

The impact is multi-fold: Through the support from a recognized international partner and through the investment in technological innovation in New Caledonia, SNN has been able to secure clients. Secondly, there is transfer of technology and skills between the organisations and its people. This also includes any relevant direct and indirect network that the Robertet group

possessed. Finally, there is a considerable impact on the time and quality factor – the industrial process applied decreases the production time from 48 to 8 hours while improving the product quality.

Through the income generated by SNN, wealth redistribution to the community is conducted in the form of “loyalty fee” within the province of Islands where SNN belongs, and part of the financial resource is used to continuously protect the environment. Last but not least, SNN is contributing to the development of the local handcraft ecosystem nearby its premises.

Success Factors

Multi-Stakeholder Cooperation

Mr. Jean Waikedre, one of the co-founders who previously worked at l’Institut de Recherche pour le Développement (IRD), brings his technical expertise as well as knowledge of the local people to complement Mr. Daniel Joulain who brings the expertise, network and distribution from Robertet Group. The collaboration between public sector and private sector resulted in this opportunity, i.e. Serei No Nengone. Mr. Waikedre did mention of the importance of the cooperation with the Robertet group as well as with the local authorities.

Furthermore, SNN has had the heavy challenge of working closely with the indigenous communities, who believe firmly in the harmonious symbioses’ between man and their local environment. SNN gained, built, and is sustainably nourishing the relationship with the local people in order to maintain peace in the local ecosystem in which it operates.

Multiple Impact

SNN is able to capitalize on its various connections. In addition, as a small business, it has successfully been able to create, sustain and leave impactful results, as noted in the previous section. These impacts are positioning SNN as a reliable and well-managed business that could attract the interest of environmentally sustainable clients and impact investors to further expand its impact while growing the business.

Case study: *Serei No Nengone*



Source: SNN



Case Study on Industrial Innovation in the Pacific Islands Vale, New Caledonia

Work Package 4

Sociedade Portuguesa de Inovação - SPI

Pacific-Europe Network For Science, Technology and Innovation



PACE-Net Plus is a project funded by the European Commission to reinforce EU-Pacific cooperation on Science, Technology & Innovation, and to promote the development of mutually beneficial partnerships. Grant Agreement no.: 609490

Executive Summary

Vale is a multinational company originated from Brazil with locations in different parts of the world. It has a strong presence in New Caledonia, whereby one of the largest nickel deposits can be found. Although it has multiple businesses, Vale remains a major global mining company and New Caledonia is one of its important markets.

This case study aims to highlight the scientific and/or technological domains and competencies implemented by Vale, distinguishing between the role of different actors and of public policy in advancing its innovation, as well as the contribution made by EU technology transfer. The case study accounts for the local context – and is developed using a combination of primary data collected through interviews and secondary data through desk research. Through its presence in New Caledonia, Vale had the opportunity to keep up with its usual business operations, but also to improve its societal & environmental footprints. The company provides jobs to around 3000 people in the country, contributing indirectly to the economic development. From an environmental point of view, Vale had to respect and ensure sustainable mining. Furthermore, the company maintains nurseries to ensure reforestation, and aligns school trips to such endeavors in order to educate the younger generation in New Caledonia. Globally, it appears that Vale is trying to ensure that it is contributing positively to both environmental and societal aspects of the society, with on average, one billion USD in investment.

Being a major listed company in Brazil, Vale presented a couple of challenges in this case study. Firstly, the information available to the public was mostly business-related, corporate social responsibility and market opportunity in nature. Secondly, the aim was to look at the business operations in New Caledonia through Vale NC whereby the available information was limited. Last but not the least, the industrial innovation happening at Vale, though both numerous and important, was not necessarily applicable to New Caledonia or coming from New Caledonia.

Given the size of the company, the innovation chosen has been around the transportation of ores from one place to another by the Valemax ship. The latter offers higher cargo capacity and considerably better port maneuvering capability. Vale had also a significant impact on the environment and social welfare in New Caledonia through its initiatives to improve the local community.

Fact Figures

Business: Mining Industry

Number of employees: 85,305 – about 3000 in New Caledonia

Turnover: around EUR 270 million (2014)

Target market in Pacific Islands: Nickel: China, Japan, Ore: Australia, China; Cobalt: Japan,

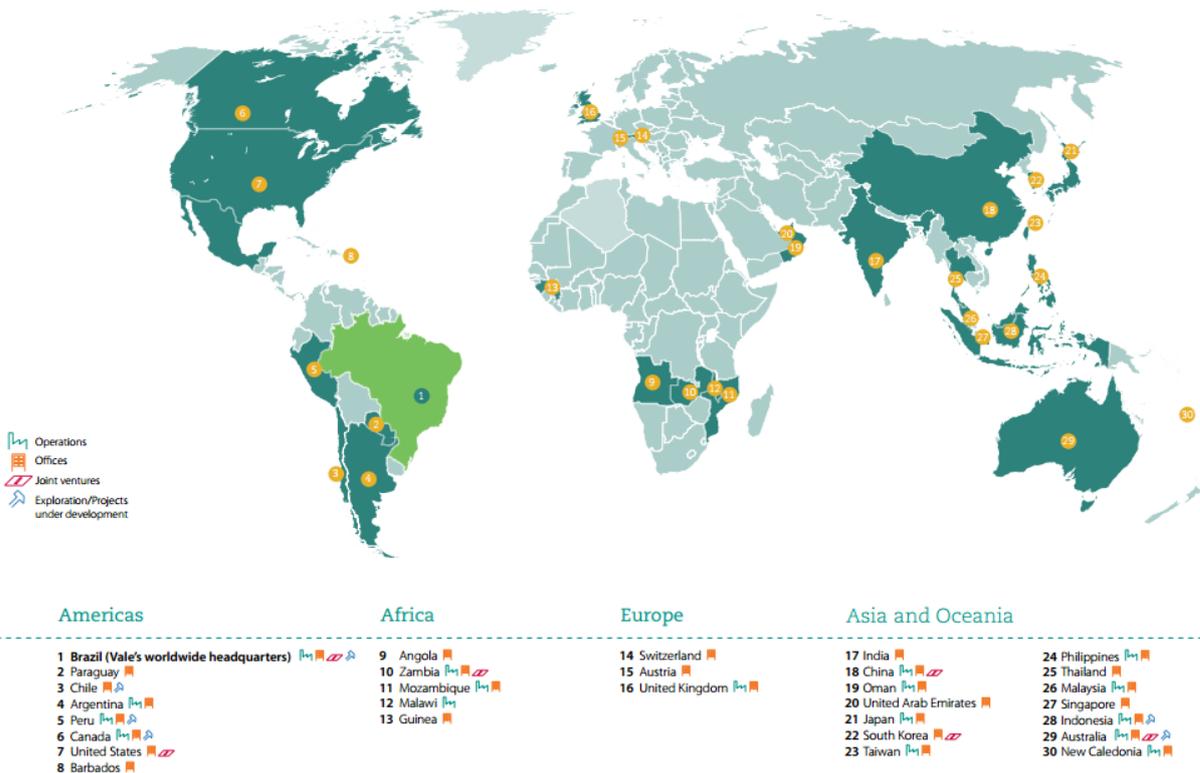
About Vale

Introduction to Vale



Vale is a Brazilian multinational diversified metals and mining corporation and one of the largest logistics operators in Brazil. In addition to being the third-largest mining company in the world, Vale is also the largest producer of iron ore, pellets, and second largest of nickel. Vale also produces manganese, ferroalloys, copper, bauxite, potash, kaolin, alumina and aluminum. In the electric energy sector, the company participates in consortia and currently operates nine hydroelectric plants. The organisation has a worldwide presence with offices & operations in 30 countries as indicated in figure 2.

Vale's operations around the world



Source: Vale⁵

Figure 2: Vale's operations around the world

⁵<http://www.vale.com/en/aboutvale/across-world/pages/default.aspx?&lang=en>

**Vale
Businesses**

Vale has set up a diversification program seeking to increase the participation of non-ferrous as part of its total revenue. In the process, the organisation seeks to reduce its dependence on the price of iron ore for both its net income and revenue. To achieve such endeavor, Vale has gone through the acquisition of Inco and Caemi. Along the way, the participation of non-ferrous metals on Vale's total revenues went from 7% in 2000 to about 34% in 2006. Furthermore, Vale branched out into the copper mining sector in 2001 through another acquisition (Sossego Mine) and inaugurated in 2004 as the first Brazilian copper mine. Through the acquisition of Canico Resources in 2005, Vale went on to increase its revenue through non-ferrous metals. In Australia, the organisation has purchased AMCI Holdings to expand its coal mining operations. It also has presence in China and Mozambique.

**Vale in New
Caledonia**

It is estimated that 30% of the world's known nickel deposits can be found in New Caledonia. For this reason, Vale is also present in the south of New Caledonia, registered as an ore mining company (limonite and saprolite) and production of nickel and cobalt. With an industrial complex, called the Deep South plant which includes (a) a mine of 1,900 hectares, a hydrometallurgical plant and a refinery, auxiliaries and leaching, (b) a port, and (c) co-operating a central electric power station. The company has about 3,000 employees including 1,350 Vale New Caledonia (VNC) employees.

Mr. Arnaud de Sainte Marie is the technical manager at Vale New Caledonia and was the contact person for the case study.

**Other
Businesses
related to Vale**

Among the other businesses under Vale, there are logistics, energy and steelmaking. Vale's logistics span from railway, shipping and ports & terminals. This integrated set of inter-connected businesses allows the organisation to quickly and safely deliver its products to its clients. For railway, Vale operates over 10,000 kilometers of railway network and has agreements in place to use lines in African countries and in Argentina. Through its subsidiary, Valor Logística Integrada, logistics services are provided to third parties. To ensure and enhance competitiveness while sustaining the expansion of its operations, Vale is continuously developing projects to increase its railroad capacity.

For ports & terminals, Vale is making use of a modern network of efficient ports and terminals, many of which are linked to their mines by railroads. With clients from all over the world, Vale has deep-draft ports which are fully equipped to receive their Valemax ships, the biggest mineral vessels in the world, each with

a capacity for 400,000 tonnes of ore. On the other hand, Floating Transfer Stations are made available for their operations in shallower ports to move the ore from Valemax ships to small vessels.

The integrated logistics chain is valuable to enabling the organisation to reduce the number of trips between Brazil and Asia, thus reducing costs & operational time while cutting down on gas emissions. Port operations are run in Argentina, Brazil, Indonesia, Malaysia and Oman, while cargo service is also provided to third parties, adding on to the revenue of the organisation. Some of Vale's operations are powered partially through its own energy generation – hydroelectric plants located in Brazil but available in Canada and Indonesia. Moreover, the organisation has set up Vale Energy Solutions to focus on the development of efficient & sustainable energy generation. Lastly, Vale also runs projects related to steelmaking in order to produce its own steel and for resale as well. However, both energy and steelmaking businesses contribute to a very small extent to Vale's total revenue.

Overview of Financial

Holistic data from Vale's previous annual reports and other publicly available information were also analysed during the study. Some of the information looked at has been the environmental & social responsibility through investment from Vale and the financial results delivered by Vale.

Factsheet

As one of the largest metals and mining company in the world, Vale has approximately 350,000 shareholders in all continents. Vale is also a leader in nickel production globally as well as producer of iron ore and iron ore pellets. By the end of the 3rd quarter of 2015, the company had a total market capitalization of USD 20 billion.

For 2014, Asia represents the largest source of operation revenue (53.6%), with a largest portion coming from China, followed by South America (19.5%), Europe (16.8%), North America (6.2%) and rest of the world (3.9%). Other regions including New Caledonia fall under the 0.4% of the operating revenue. The company is 50.2% owned by institutional investors, 33.1% by Valepar, 9.80% by retail investors, 1.7% in treasury, and 5.2% by Brazilian government. Due to the company's success, it was the second most traded company on the New York Stock Exchange in 2014.

Social and Environmental Expenditure

	2012	2013	2014
Environmental	1,025.3	1,015.0	864.8
Social	317.2	265.1	270.4
Total	1,342.5	1,280.1	1,135.2

Source: Vale 2014 Sustainability Report⁶

Figure 3: Social and Environmental Expenditure

Figure 3 provides a good indication of the expenses that Vale allocates for environmental and social wellbeing. Vale manages both its positive and negative impacts from the planning to the closure stage of its projects. The latter include all steps from implementation, operation to decommissioning steps.

Production

2014 has recorded a major achievement in New Caledonia with 19,000 tonnes of nickel produced, about 3,000 tonnes more than in 2013. Globally, expenses have been reduced by EUR 1 billion – through the employees’ resilient dedication in keeping up with the competitiveness of the mining industry through tough times and smart efficiency. Overall productions:

- a) Iron ore: 33.16 Metric tonnes
- b) Copper: 98,000 tonnes
- c) Gold: 321,000 oz
- d) Nickel: 275,000 tonnes

Focus on Industrial Innovation

Rationale behind innovation

Mr. Arnaud de Sainte-Marie shared that the main reason for doing the innovative process is to treat nickel from laterites⁷. Mr. Arnaud added that, the main technical innovation in this process lies in the primary solvent extraction to purify solution. This process was developed to avoid using very dangerous Hydrogen sulfide (H₂S) gas. He added that the main incentive was safety.

⁶<http://www.vale.com/en/aboutvale/sustainability/links/linksdownloadsdocuments/2014-sustainability-report.pdf>

⁷https://en.wikipedia.org/wiki/Lateritic_nickel_ore_deposits

Innovation leads to opportunities

Then, apex reduction has also been a reason to develop some of the "biggest" equipment in the world" in the industry, leading to innovation.

Mr. Arnaud said that safety, environment and costs are the three main reasons for innovation in Vale's case.

Challenges faced while innovating

Main challenge, according to Mr. Arnaud, is to go industrial scale with this innovation.

Brief

Innovation at Vale plays an important role for the scale of its enterprise and its operations. For instance, the company is funding projects for:

- The development of technologically advanced equipment and mining methods to make mining safer and more efficient
- The development of sophisticated software to dramatically improve our recovery rates and reduce risk underground
- For the improvement of refining processes.

Innovation through equipment

At Vale, innovation happens on a large scale with the following characteristics:

- Its autoclave can go above 260 °C (time-saving process)
- It possesses a 2 in 1 heater called fleaters (time-saving process)
- It has dirty steam recycling system – which helps to reduce environmental pollution
- One of the biggest pulsed columns in the world to extract primary solvent using Cyanex 301
- FBR roasters to produce NiO from NiCl₂
- Manganese removal from effluent using oxidizing mix of SO₂ + Air.

Innovation through other product/business lines

Transportation ores from Brazil to China is usually a costly investment whereby factors of market volatility, weather among others are often influencing the profit/loss of the company. Meanwhile, Vale has understood the need for better shipment facility – hence, developing the Valemax ships. The latter provides a suitable vessel, design to be an “ore carriers”, allowing minimal cargo movement as compared to the traditional bulk carriers. The ship's drainage

Innovation through R&D to save cost

system allows for reduced standing water facilitating more efficient unloading procedures by using 6 bilge wells per hold vs. 2 per hold in other bulk carriers. The ship, thanks again to the design, is more stable with about 60% fewer port maneuverings for the same amount of ore delivered reducing port congestion and the likelihood of accidents.

In order to maximize its revenue, and limit “waste”, Vale is developing a promising innovative technology in collaboration with the University of São Paulo to recover copper mineral from the tailings using micro-organisms, which if extended to other minerals, would transform the handling of tailings and boost mineral production. It would be immensely helpful in the production of rare minerals such as copper, whose pure form occurs in just 1% per tonne of ore extracted.

Impact

Environmental

Vale NC has maintained a nursery with capacity of more than 500 000 plants / year. Many species of the discovered were unique and specialised know-how was needed and acquired, thus allowing replanting of about 60% of the endemic species. In Brazil, Vale is a major investor in power generation (from its business perspective, this helps to protect the business from price volatility and minimise regulatory, climatic and supply-side risks) while on the environmental side: Vale has invested in biodiesel company, Biovale - a joint venture with Biopalma da Amazônia S.A. Biovale will produce a 20% biodiesel and 80% mineral diesel blend which will power its entire fleet of 216 locomotives in the North System, as well as heavy machinery at the Carajás mines. The company has also invested in major hydroelectric power station, and projects aiming for renewable and sustainable energy generation.

Society

Regarding the staffing in New Caledonia, Vale has recently appointed a director of operations to help to stabilise the changes in processes which affect employment. In general, according to Mr Arnaud de Sainte Marie of Vale NC, staff is well compensated with bonus.

Success Factors

Social	<p>From a social responsibility point of view, Vale has had the opportunity to engage with the community at various levels: For instance, it would open up its plant nursery in New Caledonia to schools as part of its educational trips. The company also engages with the local indigenous people, known as Kanak, for its cultural development activities to promote the native languages present in the south of New Caledonia.</p>
Economic	<p>With other 8100 tonnes of nickel production coming from New Caledonia in the 3rd Quarter of 2015, the estimation based on this sole number represents at least 10% of the company's global nickel production. The mining industry has created jobs for the local people, over 3000 are employees or contractors under Vale New Caledonia and thus boosted the economic activities from business and personal consumption. Vale New Caledonia is also the 2nd largest employer in southern province of New Caledonia.</p>
Environmental	<p>In 2008, Vale New Caledonia and communities south of the Grand signed The Pact for Sustainable Development of the Deep South for a period of 30 years. The aim has been to urge the industry to create and implement specific measures to support the development of the Deep South in a sustainable manner. The Pact was set up around the 3 areas: New Caledonia Vale Foundation, Customary Environmental Advisory Committee, and the association of reforestation. These structures are now actively supporting the socio-economic and cultural community projects of the area <i>DjubeaKapume</i>. The New Caledonia Vale Foundation is the first corporate foundation in the country for the financing of educational and socio-economic cultural projects.</p>