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| GenicsAN ON PROGRAM CASE STUDY |
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| GENICS case study executive summary |
| Key findings* Genics comprises two products: a prawn (shrimp) pathogen detection technology that can quickly detect multiple pathogens in shrimp in a single test, and a heritage panel that determines stock pedigree and genetic relationships in prawns.
* Current testing methods typically can only detect a single pathogen per test, which is costly and can be inaccurate. Faster, more comprehensive and cost effective pathogen testing means that prawn farmers can be equipped with the information they need to effectively manage their stock.
* It is anticipated that this technology will in future benefit the fish, porcine and bird industries that are also vulnerable to diseases that drive the overuse of antibiotics and can result in large scale stock losses.
* Without the ON program it is likely the technology would never have been commercialised.

Role played by CSIRO ON program* Genics participated in ON Prime in 2017 and ON Accelerate in 2018.
* Participation in the ON program encouraged the team to focus on market fit and undertake detailed customer analysis. It provided the team with greater clarity and confidence that they had a superior solution to a global problem. Participation in ON’s mentoring program also allowed the Genics team to forge invaluable international connections. This elevated the profile of the company and provided access to other professional capabilities.
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This case study uses the evaluation framework outlined in the CSIRO Impact Evaluation Guide. The results of applying that framework to the Genics case study are summarised in Figure 1.

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| Figure  1 genics case study – IMPACT FRAMEWORK |
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| **INPUTS** | ▶ | **ACTIVITIES** | ▶ | **OUTPUTS** | ▶ | **OUTCOMES** | ▶ | **IMPACTS** |
|  |  |  |  |  |  |  |  |  |
| * Financial and in-kind contributions of over $2 million
 |  | * Established a transactional website for Shrimp Multipath and Shrimp ID
* Developed a pitch pack for investors
* Established a company with 9 staff
* Gained domestic support and built international reputation and networks
 |  | * A strong record of publications with international reach
* New technologies and techniques for pathogen detection
* Approved testing provider for the domestic prawn farming industry
 |  | * Faster delivery of results across multiple pathogens
* More cost effective option for pathogen testing
* Farmers and others in the supply chain are better informed and manage prawn stock more effectively
 |  | * Increased aquaculture production through improvements in breeding, feeds, health care, disease control and changes in production systems
* Future applications in in fish, porcine and bird industries allow for increased food production without expanding agricultural land
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| Source: acil allen |
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* 1. 1. Purpose and audience for case study

This case study describes the economic, environmental and social benefits arising from the Genics project.

This evaluation is being undertaken to assess the positive impacts arising from the Genics project’s participation in the CSIRO’s ON. This case study can be read as a standalone document or aggregated with other case studies to substantiate the impact and value of the CSIRO ON activities as a whole, relative to the funds invested in these activities.

The information in this case study is provided for accountability, communication and continual improvement purposes. Audiences for this report may include Members of Parliament, Government Departments, ON, CSIRO and the general public.

#### CSIRO ON

CSIRO ON was established in 2015 as a four year program by CSIRO to help accelerate the impact of science research into market (the program ends in June 2020). The initiative was expanded through funding from NISA to service more broadly Australia’s publicly funded researchers and their industry partners. The aim of the initiative is to more quickly translate great science and technology research into positive impact to help address some of the economic, environmental and social challenges facing the Australian and global community.

There are a number of elements to the program, including two facilitated programs, ON Prime and ON Accelerate. These two elements are designed to complement each other.

ON Prime is an open and collaborative program for existing science projects as well as new technologies and projects that are still in development. ON Prime helps research teams to ensure that they are working on the right problem, it provides frameworks to create and test assumptions about their idea and provide recommendations towards next steps. ON Prime can be considered as an entry level program, in effect it can be seen as a precursor to participation in the ON Accelerate program.

ON Accelerate is designed for teams that have made significant progress with their idea and their target market(s). This may be in the form of contracts for paid or unpaid trials, or at the most advanced stage, recurring sales with both new and existing customers. This implies that teams will have a working prototype of their product or service and have secured any appropriate intellectual property rights. It is expected that teams applying for ON Accelerate would have conducted significant engagement with their potential customers and be able to demonstrate what they learned throughout, including what the total addressable market is and what competition exists.

For ON Accelerate, shortlisted applicants are invited to participate in a two-day Selection Bootcamp event where teams will be provided with training and coaching simulating the accelerator experience. At the conclusion of the selection bootcamp, the teams will pitch to a panel of external judges for a spot in the Accelerator. Projects that are at Investment Readiness Level (IRL) Stage 3 can apply directly for ON Accelerate without going through Prime or Bootcamp.

Following a team’s passage through the ON Prime or ON Accelerate program they are eligible to apply for ON Runway support. That funding is designed to help teams to further progress their project. The support provided can be spent on a range of services, for example, regulatory certification, marketing, bookkeeping or investor agreements.

The program is expected to exceed its targets for participation. It is predicted that it will have reached 515 teams with over 1,850 people by the time it concludes on 30 June 2020.

* 1. 2. Background

Pathogens (infectious agents) in prawn aquaculture cause $18 billion p.a. in lost production globally.[[1]](#footnote-1) The most recent and well known example was the highly contagious ‘white spot’ disease that in 2016 closed down south-east Queensland’s prawn industry, which is responsible for around producing 40 percent of Australia’s farmed prawns. [[2]](#footnote-2)

Prawns can have multiple pathogens, yet current technology can only test for a single pathogen at a time. This makes detection tests costly when multiple pathogens are possible. This, combined with difficulties in obtaining results in a timeframe to suit on-farm decision making, means that it is possible that seedstock producers, research agencies and commercial prawn farms may be reluctant to conduct screening. This increases farmers reliance on chemicals, antibiotics and probiotics, and generates risks for Australia’s biosecurity.

Genics is a technology that advances the prawn pathogen detection and breeding selection. Genics makes multi-pathogen testing viable for shrimp breeding companies, hatcheries and farms, thereby reducing testing costs and improving the data delivery time to support informed decisions. Genics currently has two products:

* Shrimp MultiPath which can detect 13 commercially important pathogens in shrimp as well as various genetic variants; it can generate in excess of 600 data points per sample which is stored in a cloud hosted database that is readily accessible for disease surveillance; and
* Shrimp ID which is a heritage panel that determines stock pedigree and genetic relationships in prawns. This enables farmers to make better breeding choices by providing pedigree and relationship assignment information that supports decision about genetic diversity.
	1. 3. Impact pathway
		1. 3.1 Project inputs

The total cost for the Genics project was $2,091,164 million in cash and in-kind contributions (see Table 1). The ON program contributed $495,735 in cash (around 25 per cent of the total cost). Other contributors were the Commonwealth and Queensland governments.

Table 1 support for the genics project

| Contributor / type of support | 2017 ($) | 2018 ($) | 2019 ($) | 2020 ($) |
| --- | --- | --- | --- | --- |
| **Cash** |  |  |  |  |
| Personal investment |  | 1,000 |  |  |
| Commonwealth Government Accelerating Commercialisation Grant (Poultry) |  | 350,769 | 146,000 |  |
| Commonwealth Government Accelerating Commercialisation Grant (Shrimp) |  | 30,000 |  |  |
| Menzies Science Entrepreneurship Fellowship  |  |  | 22,500 | 67,500 |
| Qld Government Ignite Grant |  | 100,000 |  |  |
| Fisheries RDC research project |  | 163,660 |  |  |
| Sales revenue reinvested |  |  |  | 144,000 |
| ON Prime  | 13,955 |  |  |  |
| ON Runway & New Venture Services |  | 119,335 | 53,303 |  |
| ON Accelerate |  | 309,142 |  |  |
| **In-kind** |  |  |  |  |
| Founders and their families | Unpaid work | Unpaid work |  |  |
| Experts in Residence |  | 54,000 | 330,000 | 330,000 |
| Australian Prawn Farmers Association |  | Clinical sample materials |  |  |
| **TOTAL** | **13,955** | **1,127,906** | **551,803** | **441,500** |
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* + 1. 3.2 Project activities

The technology underpinning Genics was developed at CSIRO over many years. Genics was registered as a company in 2018, shortly before participating in ON Accelerate. Since that time, it has:

* Established a website via which clients can source information and order services
* Established a company structure that includes a team of six, with an additional three expert advisors
* Built an international presence through conference presentations including the Infofish World Shrimp Trade Conference (2019) and the Aquaculture America Conference (2020) and partnerships in Kenya and Ecuador (in Ecuador the company is Called Genics Ecuador S.A.)
* Developed a pitch pack for potential investors (Genics are currently undertaking a Series A capital raising of US$2 million).

###### Role of the ON program

Participation in the ON program encouraged the team to focus on market fit and undertake more customer analysis. Genics interviewed 50 potential customers both during and after the ON Prime2 program. All indicated that a pathogen detection system could fill an immediate market need, with many offering and willing to be early adopters. The Australian Prawn Farmers Association (current representing 99% of Australians prawn producers) fully endorse the development of the testing panel. As a result, they developed greater confidence in the potential of Genics on the domestic market. This is 2 percent of the global prawn market.

Participation in ON also provided the team with greater clarity and confidence that they had a solution to a global problem and that the current technology and services for pathogen testing could be improved. That is, Genics offers a unique solution.

Through participation in ON’s mentoring program the team were able to establish a strong network of professional colleagues around the world. This elevated the profile of the CSIRO and Genics and provided the team with access to other sources of insight and capability in relation to the detection of prawn pathogens.

* + 1. 3.3 Project outputs

#### Publications

The following are examples of some of the publications published by the Genic research team:

* Newman, S., ‘Testing of Penaeid Broodstock for Multiple Pathogens: Should it be mandatory?’ *Aquaculture* *Magazine* (2020) 76
* Olivier, I., Sellars, M.J, Preston, N., ‘Shrimp Multipath: Providing a pathogen safeguard to Kenya’s emerging integrated mangrove conservations and aquaculture enterprises’ *Aquaculture Magazine* (2019) 16
* Sellars, M.J, Cowley, JA et al ‘Reduced growth performance of Black Tiger shrimp infected with infectious hypodermal and hematopoietic necrosis virus’ *Aquaculture* 499 (2019) 160
* Sellars, M.J., ‘Innovations: Breakthrough in shrimp disease prevention’, *InfoFish International* 5 (2019) 77

#### Awards

In 2018 a member of the Genics team won the Women in Aquaculture Award from the Australian Prawn Farmers Association.

The team also won CSIRO ON Impact Award in 2019 and

#### Innovation / commercialisation

Genics is an approved testing provider used by the Australian prawn farming industry in order to satisfy the Queensland’s and New South Wales’ regulatory requirements around prawn translocation and health testing.

CSIRO own the IP on the test designs. Genics believes the nature of the IP will need to be considered when marketing the prawn pathogen detection system to minimise chances of the IP being reverse engineered or mimicked. CSIRO designed the tests based on applicable pathogen genome sequence data, as well as in-house proprietary knowledge of some viral genome sequences.

There have been several capital injections made in the technology (see Table 1).

###### Role of ON program

Participation in ON assisted the Genics team to establish domestic recognition in the aquaculture industry and forge international relationships that are a source of technical expertise and business potential.

It also enhanced the value of the IP in Genics’ products and future licensing opportunities, owned currently by the CSIRO.

* + 1. 3.4 Project Outcomes

Genics is in the early stages of its development. Notable outcomes to date include:

* Global recognition of the two Australian products (Shrimp Multipath and Shrimp ID) and networks and support for the Genics team.
* Shrimp samples for pathogen testing have been received from 15 countries within 10 months of commercial operation, including repeat customers. Repeat domestic customers use Genics for their monthly regulated translocation testing and their three monthly health checks of breeding stocks. Whereas repeat overseas customers use Genics technology for their regular health screening checks of breeding stocks and post-larval production.
* Shrimp ID panels have been trialled and tested for over five years on populations of Pacific White and Black Tiger shrimp from around the world. The technology is also being used commercially. Genics is currently focussed on marketing the Multipath technology to customers, however they also have customers in Colombia, Thailand and Asia-Pacific that are using the ID panels.

###### Role of the ON program

Participation in ON encouraged the team to closely investigate the market potential and competitors for Genics, and to pursue a business model that offers the domestic and global prawn industry a unique, fast and cost effective alternative to existing services.

* + 1. 3.5 Adoption

Genics anticipates three potential markets for its products:

1. The domestic Australian prawn farming industry (5 farms which produce seedstock) and CSIROs existing national clients. This segment spends approximately $780,000 a year on pathogen screening in the brood stock component of their businesses.
2. CSIROs international clients, in particular Vietnam’s largest seedstock producer with which CSIRO has long-term collaborative agreements. This company spends approximately $2.2 million a year on pathogen screening.
3. The global prawn aquaculture industry. Genics’ pathology testing technology targets around 30 per cent of the current tests on prawns. This market is currently worth around $75 million a year (and growing at around 9 per cent a year). Due to nuances of government policies in different countries, this will be a complex market to penetrate. For the purpose of our analysis ACIL Allen has assumed that Genics will grow over time to capture 5 per cent of the market.

This market evaluation is based on Genics assessment of the current expenditure of prawn pathogen diagnostics globally and does not take into consideration new markets that will eventuate as a result of the utility of the prawn pathogen detection system.

Genics note that their competitors are university, commercial and government laboratories that undertake commercial diagnostic testing for prawn pathogens. Within Australia, the laboratories include EcoDiagnostics (WA), Agrigen (NSW), Elizabeth MacArthur Agricultural Institute (NSW), Biosecurity Sciences Laboratory (QLD) and James Cook University (QLD). Domestic pricing schedules range from an R&D subsidised $30 to $100-120 per pathogen per sample and have turnaround times from 1-90 days.

Meeting the regulatory requirements is important to the adoption of Genics. In Australia, the regulatory requirements include Biosecurity Acts which regulate the use of test kits for exotic diseases, NATA accreditation to ISO/IEC17015[[3]](#footnote-3) of kit and laboratory (this has been completed for Shrimp Multipath) and approval by the Chief Veterinary Officers (received for both Multipath and ID).

###### Role of the ON program

Participation in ON encouraged a focus on competitors and their growth trajectories, and the market for the services provided by Genics both domestically and internationally. That analysis, as outlined above, assisted the team to identify the value proposition and the growth targets that Genics required to be viable.

* + 1. 3.6 Impacts

Shrimp aquaculture is a $45 billion industry. It has 2 million hectares under production in semi-intensive and intensive ponds, engaging 100,000’s of famers globally. With the trend towards increasing intensity of production, disease can be devastating and promote governments to adopt greater import restrictions and other biosecurity regulations.

As prawns often harbour multiple pathogens at any one time, Genics provides industry with a complete picture of the pathogen status within a sample in a timely manner, and more cost effectively. This data is expected to empower the farmer with the knowledge to better manage pathogens within the culture system, enabling informed management decisions on when to cull stock and when to harvest based on pathogen loading and risk.

It is also plausible to link knowledge on pathogen loading to daily feed intake of prawns and aeration requirements, with feed and power (mainly for aerators) being the two most expensive inputs to grow prawns globally. As industry become familiar with knowing the pathogen loading of their animals under culture, it is anticipated that they will swiftly utilise this data to manage feeding regimes and aeration to maximise profit. The total value of these new markets is difficult to estimate and in the order of 10-fold greater than the already existing prawn pathogen diagnostics market.

###### Role of the ON program

ON has allowed Genics to de-risk the opportunity to take market its technology. It has allowed Genics to identify markets and establish networks to deliver a service to the market. ON has provided (and continues to provide) Genics with a network of people that can troubleshoot and address questions and challenges as they arise.

* 1. 4. Clarifying the Impacts

There are a number of competitors to Genics’s multipath panel tests. The market currently predominantly uses single test assays (either ELISA and PCR Kits). There are many manufacturers manufacturing shrimp testing kits (for example, Gene-Reach, ThermoFisher, Nam Anh Biomed Tech Co).

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| Figure 2 Competitor analysis |
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| \* Current Shrimp MultiPath (SMP) has 13 tests plus internal quality controls in each sample well\*\* SMP example however more test are possible per sample using the Genics technolSource:Genics investor presentation  |
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* + 1. 4.1 Counterfactual

In the absence of the ON program it is unlikely that the MultiPath opportunity would have been de-risked as it entered the marketplace. As a biotech solution, the procedure may never have been able to move from being a research product to become a commercially available product or service. In the absence of the ON program it is likely that the technology would have remained on the shelf in CSIRO. Without the establishment of Genics and the support of the inventor of the product, this product would have failed at the point of setting up the commercial workflow.

* + 1. 4.2 Attribution

As this technology would not have been commercialised in the absence of the ON program ACIL Allen has attributed 100 per cent of the benefits from the commercialisation of this technology to that program.

* 1. 5. Evaluating the Impacts
		1. 5.1 Cost-Benefit Analysis
			1. Benefits

The actual revenues for Genics in 2019-20 were $191,316 which was a 200% increase on the previous financial year. The projected revenues of Genics were estimated using the following assumptions:

* Genics products are capable of providing testing to 30% of worldwide testing market (estimated at $75 million annually, growing at 9% annually).
* Due to difficulties in penetrating this market it is assumed that at most 5 per cent of this market will be penetrated by Genics (i.e. 1.5 % of the total world testing market).
* The rate of penetration will increase over the next 10 years until the full 1.5 % of the world market is captured by 2027/28.

The total revenues of Genics between 2016/17 and 2030/31 with participation in the ON program are shown in **Figure 3**. In the counterfactual (“without ON participation”), revenues are assumed to be zero as it is assumed there was no commercialisation and no product sold.

The incremental revenues (that is, the difference in projected revenues between the two cases) represent a conservative valuation of the benefits generated by Genics, as they do not take into account the “consumer surplus” enjoyed by customers. (That is, some customers would have been willing to pay more than the price charged by Genics, based on the quantum of benefits they expect to gain from purchasing the product/service). Conversely, the benefits of Genics domestic operations will be overestimated using this methodology as there are domestic suppliers already servicing the Australian market. However, this will have negligible impact on the results as the domestic market is quickly dwarfed by the international market.

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| **Figure 3** Genics revenues with participation in the ON program, 2016/17 to 2026/27 (2019/20 dollars) |
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| Note: Revenues without participation in the ON program are assumed to be zero. *Source: ACIL Allen estimates based on Genics information*  |
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It is assumed that the benefits stream will cease after 2030/31 due to the introduction of similar products in the marketplace by other Australian companies.

* + - 1. Costs

The costs included in the analysis include ON related costs, other upfront cash and in-kind support, and the cost of foreign-sourced inputs which represent a “leakage” out of the Australian economy.

As can be seen in **Table 1** the ON-related costs of the Genics project were just under $495,735. Other upfront cash and in-kind support totalled $1.7 million. This results in a total upfront cost of $2.2 million. The counterfactual is that the product remained on the shelf in CSIRO without any further work, as such all upfront cash and in-kind support are included as costs in the CBA and there is assumed to be very little or no activity in the counter factual.

The projected total operating costs of Genics between 2018/19 and 2030/31 with and without participation in the ON program are shown in **Figure 1.3**. The costs were estimated to be 50 per cent of revenue. Note that the CBA assumes that the costs in the counterfactual (“without ON participation”) are assumed to be zero as it is assumed there was no commercialisation and no product produced and sold.

Note that only the foreign-sourced inputs are included in the CBA as true costs as these represent a “leakage” out of the Australian economy. We have assumed that 20 per cent of production costs are spent on foreign-sourced inputs (See **Figure 4**).

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| **Figure 4** Projected Genics costs with participation in the ON program, 2018/19 to 2026/27 (2019/20 dollars) |
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| *Source: ACIL Allen estimates based on Genics information* |
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#### Net value added

Taking into account this “leakage”, the net value added to the Australian economy by Genics (relative to the counterfactual where the ON program did not exist) is shown in **Figure 5**.

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| **Figure 5** Net value added to Australia by Genics, 2018/19 to 2026/27. (2019/20 dollars) |
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| *Note: Note this excludes the upfront ON costs, and other cash and in-kind support.**Source: Genics* |
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* + - 1. Assessment of benefits against costs

The present value of upfront ON-related costs and other cash and in-kind support incurred by Genics is $2.3 million in 2019/20 dollars. The present value of benefits associated with participation in the ON program is estimated at $18.8 million in 2019/20 dollars under a 7 per cent real discount rate.

The net present value (NPV) of participation in the ON program is thus $16.5 million under the 7 per cent real discount rate, while the benefit-cost ratio (BCR) is 8.2. The NPV is calculated by subtracting the present value of costs from the present value of benefits, while the BCR is calculated by dividing the present value of benefits by the present value of costs.

* + - 1. Sensitivity analysis

If the projected revenues of Genics (with participation in the ON program) between 2018/19 and 2030/31 are 20 per cent higher than those in the central case, the BCR will increase from 8.2 to 9.9. Conversely, if the projected revenues between 2018/19 and 2026/27 are 20 per cent lower than those in the central case, the BCR will decrease to 6.6.

If the projected operational costs and cost of goods sold of Genics (with participation in the ON program) between 2018/19 and 2030/31 are 20 per cent higher than those in the central case of the cost-benefit analysis, the BCR will decrease from 8.2 to 8.0. Conversely, if the projected operational costs and cost of goods sold between 2017/18 and 2026/27 are 20 per cent lower than those in the central case, the BCR will increase to 8.4.

In the central case of the cost-benefit analysis, a 7 per cent real discount rate has been used. The BCR increases to 10.4 under a 4 per cent real discount rate and decreases to 6.6 under a 10 per cent real discount rate.

* + 1. 5.2 Potential future impacts

Genics is currently exploring a number of future applications of its technology in food production areas that involve intensive farming and a high susceptibility to disease. These include:

* the avian industry to detect Salmonella, Cursal Disease and E. coli
* citrus orchards as many food production crops are susceptible to disease epidemics and plants can be screened in the same way as animals
* the pork industry, as African Swine Fever is driving the need for throughput testing
* the aquaculture sector including salmon, kingfish and tilapia as common examples of intensively farmed fish food that are susceptible to disease

###### The ON program’s role

Any future use of this technology for the applications listed above can be linked back to the role that the ON program played in helping to bring the technology into the market.

1. Genics ON Accelerator Application [↑](#footnote-ref-1)
2. CSIRO News ‘Science delivers more Aussie grown prawns for Christmas’ <https://www.csiro.au/en/News/News-releases/2019/Science-delivers-more-Aussie-grown-prawns-for-Christmas> view on 18/02/2020. [↑](#footnote-ref-2)
3. National Association of Testing Authorities (NATA) standard for labs to hold accreditation and be deemed technically competent. [↑](#footnote-ref-3)