

# 10 Things

to consider before  
bringing a new  
aquafeed ingredient to  
market



Wittaya  
Aqua



# Introduction

The purpose of this E-book is to provide a resource for companies that are interested in, or are currently, bringing a new ingredient to the aquafeed market.

Wittaya Aqua routinely reviews “go-to-market” plans from ingredient companies and we have found that many companies engaged in this process are lacking a complete and holistic understanding of the steps that are required to take an ingredient from concept to commercialization.

This document outlines our view of some of the steps that are commonly overlooked. The steps and strategy required to commercialize a product will vary based on the product, destination market, species, feed type, etc.; accordingly, the process described herein is meant only to be a guide.

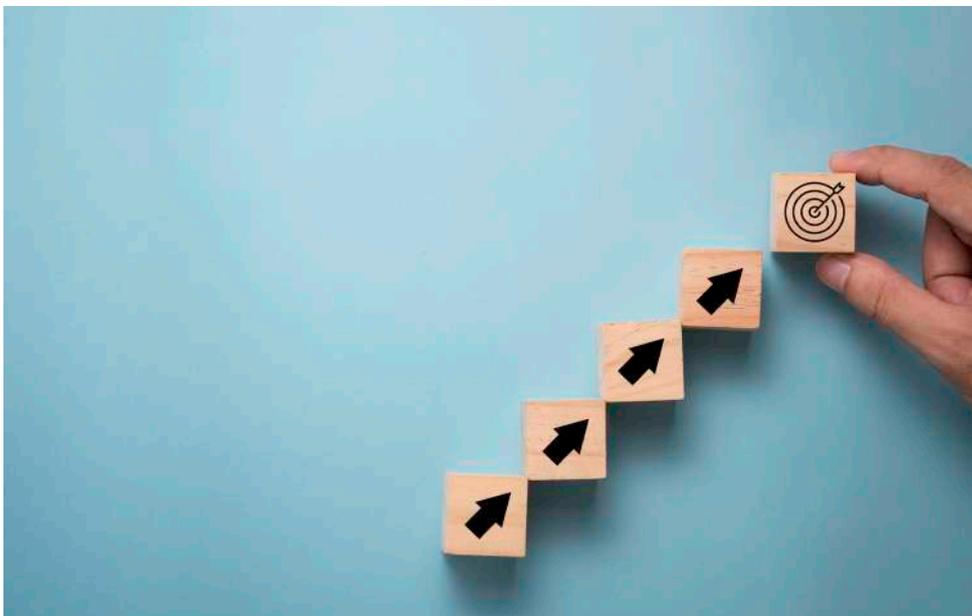
# Step 1

## Determine your goals and objectives

When developing any new product, it is imperative to first begin with defining your goals and objectives. Goals are general statements of desired achievement, while objectives are the specific steps or actions you take to reach your goals.

Goals can be abstract and overarching targets, whereas objectives should be specific and measurable. Moreover, both goals and objectives should be helpful in clarifying purpose and in determining tangible actions for advancement.

For example, an overarching goal is to develop a novel and sustainable ingredient and bring it to market and to make it profitable within a certain time frame.



Several objectives are necessary to achieve this goal including many of the steps outlined in this document (i.e., determine the product's scalability, conduct trials to test the product and determine its nutritive value, acquire regulatory approval or compliance for your product, etc.). Some examples of questions that may be useful in guiding the development of goals and objectives particularly with regard to the process of bringing a new ingredient to the aquaculture market include:

- Why is your company interested in the aquaculture industry?
- What does your company have to offer or provide to the aquaculture industry? What problem(s) are you trying to solve?
- Does your company currently have a product that you are looking to expand into new markets (i.e., aquaculture) or are you interested in developing and bringing a new product to market?
- Do you want to provide the aquaculture industry with a niche product or with a mass market commodity? (e.g., feed additive vs. an alternative raw material)

There are some factors specific to the aquaculture industry that should also be considered during the development of goals and objectives.

Firstly, the aquaculture and aquaculture feed industries are highly dynamic and rapidly growing agricultural sectors. Between 2001 and 2018, aquaculture production increased at an average annual rate of 5.3%. In 2019, aquaculture feed production experienced a growth of 4%, reaching 41 million tonnes.

Secondly, aquaculture is an incredibly diverse industry encompassing the production of 622 aquatic species and species groups. Despite the number of species cultured, the production of finfish is dominated by 27 species and species groups (FAO, 2020). Still, this represents a wide variety of species.

Lastly, these species are raised in several different production systems (e.g., ponds, raceways, recirculating aquaculture systems, etc.) and in different environments (e.g., freshwater, seawater, and brackish water). These, and other characteristics of the aquaculture industry prompt several additional considerations when defining goals and objectives:

- Will the production of your ingredient be able to meet the demands of a rapidly growing industry such as aquaculture?
- Will you target the use of your ingredient in feeds for one specific species or in feeds for multiple species? Which species?
- Will your ingredient be used in feeds for species raised in different production systems/environments? What, if any, impact will the inclusion of your ingredient in aquaculture feeds have on the production systems?

Taken together, these considerations will be helpful in better defining your company's goals and objectives for your novel or existing ingredient within the aquaculture sector.



# Step 2

## Know your market fit

As described above, the aquaculture and aquaculture feed industries are highly diverse sectors. It is therefore critical to have an idea of which sectors of the aquaculture/aquafeed markets you are interested in supplying your ingredient to.

This could include a specific species or multiple species. Likewise, your ingredient may be focused on one type of production system such as recirculating aquaculture systems (RAS) or may be best suited for feeds intended for species reared in multiple production systems (cages, ponds, RAS, etc.).

It is important to consider the specific characteristics of the sector of the aquaculture industry you are interested in. Some sectors experience more rapid growth than others and this may have implications for scaling your production. Knowing your market fit also involves aligning your company's interests with the market that your product is best suited for. In other words, your company's interests or goals and objectives must be consistent with the market position of your product.



For example, many companies aim to market their product within the salmon industry due to the fact that salmon is a high value species. However, given the competitiveness, relatively low volumes, and high nutrient density of salmon feeds, the product may be better suited to a lower value species with higher production volumes such as tilapia or catfish. Properly positioning your product within the market requires research and a willingness to adapt to market needs as well as a good grasp on the attributes of your product.

In addition to considering which species and system types your company wants to target, it is important to consider how you want to market your product geographically. Globally, aquaculture is dominated by Asia which has produced 89% of the global total output in volume over the last 20 years. Since 1991, China has produced more aquatic food than the rest of the world combined (FAO, 2020). In 2017, China produced 64 million tonnes or 57.5% of total global production. Other major producing countries include Indonesia (16 million tonnes), India (6.2 million tonnes), Viet Nam (3.8 million tonnes), Bangladesh (2.3 million tonnes), the Republic of Korea (2.3 million tonnes), and the Philippines (2.2 million tonnes). Egypt, Norway, and Chile were also major contributors to world aquaculture producing 1.4, 1.3, and 1.2 million tonnes, respectively (Tacon, 2019). The global breakdown of aquaculture production will impact the logistics and distribution of your product. Your company will have to strategically locate its production facilities in the regions it wants to supply or develop a suitable plan for distributing product to those markets.



# Step 3

## Determine your product's scalability

Aside from supporting good growth and health of animals (i.e., nutritional aspects), a “good” ingredient must also have a scalable production in order to meet the demands of the rapidly growing aquafeed sector.

Many ingredients can be successful at a pilot-scale production level, but in order to be economically viable and sustainable, ingredients must be produced in volumes high enough to be both profitable and satisfy market demand. Scalability will be influenced by the process(es) required to produce an ingredient.

Scale-up of any production process will require logistical considerations in terms of equipment, storage (warehousing), transport, and distribution. Quality and consistency of the product and the production capacity are also critical factors to consider when upscaling production.



Additionally, the price of the product must remain competitive when the process is scaled-up in order for the ingredient to be a viable option for inclusion in aquaculture feeds.

An example of an ingredient that has shown high promise for use in aquaculture feeds based on its nutritive value, but which has faced challenges in terms of scalability is insect meal.

The low volume of insect meal currently produced (as little as 10,000 tonnes) has been attributed to limited production capacity, high production costs, and legislative constraints.

It is estimated that by 2030, 500,000 tonnes of insect protein will be produced, with 200,000 tonnes utilized by aquaculture feed.

However, this volume represents less than 1% of the global aquafeed market. The high cost and low production volume of insect meal make it more of a niche product for use in aquafeed rather than a mainstream ingredient.



# Step 4

## Define your product

Defining your ingredient is an essential step in bringing it to market. This includes conducting product characterization and generating technical specifications for your product.

It is important to know what type of product you want to supply the market with. For example, you should consider whether your product is a protein or fat source. Product characterization for an ingredient at a basic level often involves the analysis of its proximate composition (crude protein, crude lipid, ash, and gross energy).

Usually, more detailed nutritional analysis is required to make a product marketable. Such analyses include crude fiber, starch, amino acids, minerals (particularly calcium and phosphorous), vitamins, and fatty acids.

New ingredients should also be analyzed for the presence of non-desirables such as anti-nutritional factors and contaminants.

Anti-nutritional factors include compounds such as anti-trypsin factors, gossypol, glucosinolates, sinapine, tannins, lectins, cyanogens, isoflavones, and soyasaponins that can interfere with metabolic processes and impact performance of fed animals.

Contaminants can include such things as mycotoxins, heavy metals, dioxins and PCB's, hormones, pesticides, etc., that present food safety concerns.

Defining your product should also involve determining if it has any functional properties. A functional ingredient can be defined as an ingredient that improves animal performance and well-being more than what can be explained solely by nutrition.

Ingredients with functional health properties are becoming increasingly important as alternatives to antibiotics and other therapeutants.

Functional ingredients contain bioactive compounds or properties that have positive effects on the digestive process, intestinal barrier function, and intestinal and animal health or immune status.

An example of an ingredient with functional properties used in aquaculture feeds is prebiotics. Use of prebiotics in fish feeds is associated with improvements in growth, feed efficiency, gut microbiota, digestive enzyme activities, gut morphology, immune status, disease resistance, intermediary metabolism, and stress response (Guerreiro et al., 2017).



# Step 5

## Test your product and determine its nutritive value

Testing your product and determining its nutritive value through research trials to assess its safety, its impact on growth, digestibility and survival, and its functional properties for a given species are important considerations.

Investing in research and development (R&D) is critical to the success of new products. Potential customers will want to know how well the product performs before they consider purchasing.

Precise feed formulation can only be achieved with well characterized ingredients. Defining the nutritive value of the ingredient allows potential customers to determine if/how the ingredient can be best utilized in feed formulations.

It is important to conduct high-quality research so that evidence-based decisions concerning the ingredient, including its inclusion in feed formulations and its price, can be made accurately and with confidence. Multiple trials may need to be conducted for different species and/or production systems.

The first step in testing your product is to find a suitable R&D center to partner with and carry out the appropriate trial(s). Options for R&D partners vary from universities to contract research organizations (CROs).

The reputation and track record of the institution or organization selected to conduct the research trials must be carefully considered. Moreover, the range of services to be provided must be considered.

For example, will you be involved in all aspects of the project including the experimental design and feed formulation or will you entrust such aspects of the trial(s) to your R&D partner?

The main types of trials which are conducted to test ingredients in aquafeeds are growth, digestibility, and disease challenge trials. Depending on the objective of your ingredient, the feed formulation for the growth trial will vary.

If your objective is to provide a replacement for fish meal or another ingredient commonly used in aquaculture feeds, then the feed formulation will likely include several diets with graded levels of your company's ingredient at the expense of the ingredient you aim to replace.

If your ingredient is a feed additive, the experimental design may include diets both with and without the feed additive and possibly the feed additive at different inclusion rates.

Depending on the samples collected, growth trials can examine several parameters. Those parameters most commonly examined include weight gain, feed intake, feed conversion ratio (FCR), growth rate (expressed as thermal-unit growth coefficient; TGC), whole-body composition (crude protein, crude lipid, water, ash), nitrogen retention (RN), recovered energy (RE), nitrogen retention efficiency (NRE), and energy retention efficiency (ERE).

Additional parameters related to blood biochemistry and immune function, for example, can also be investigated if you want to explore whether your ingredient has functional properties as described above.

The digestibility of an ingredient is key for any ingredients that are supplying nutrients to the feed.

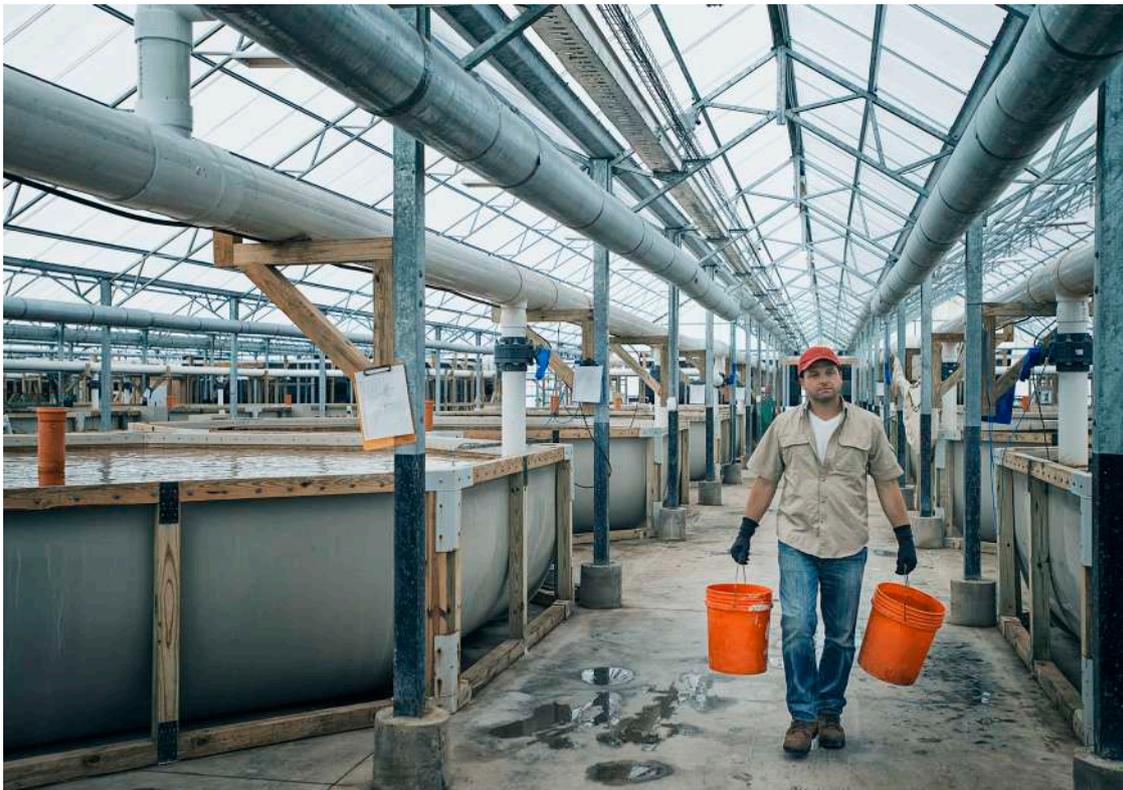
Digestibility can be assessed by comparison of the apparent digestibility coefficient (ADC) of a reference and test diet, with the test diet being a mixture of the reference diet and the test ingredient. Inclusion of an inert digestibility indicator in the diets allows the ADCs of the energy and nutrients in the diets and test ingredient to be calculated from measurement of the ratios of nutrient or energy to indicator in the diet and feces.

Fecal collection can be accomplished using various methods with passive methods including settling or filtration columns and rotating screens providing the most accurate results (Cho et al., 1982; Hajen et al., 1993; Ogino et al., 1973).

Disease challenge trials can be conducted to determine the impact of a feed ingredient on survival of aquatic species challenged or infected with a particular pathogen.

Such trials may be particularly relevant if you have evidence (or want to establish evidence) that your ingredient has functional properties.

In a disease challenge trial, the species of choice are infected with a pathogen of interest. Survival is then measured and reported over time. It is important to select a pathogen that is relevant to the species and culture system/environment you are interested in.



# Step 6

## Determine the impact of your product on feed

Beyond determining an ingredient's nutritive value, the physical characteristics of feed ingredients are an important consideration in feed formulation and must therefore be considered during the initial evaluation of any ingredient.

The effect that inclusion of an ingredient in the feed will have on the physical properties of the resultant pellets is critical.

If an ingredient cannot be introduced into a feed in a manner that allows its processing in a suitable way, then it is of diminished value as a feed ingredient.

Alternatively, some ingredients may add value to a diet based on some physical characteristics that they contribute to a formulation.

The characteristics of an ingredient which are desired are those that result in a final product with properties that provide advantages for feeding aquatic species.

Ingredients can influence various properties of finished feeds such as density, hardness, sinking rate, pellet (water) stability, degree of starch gelatinization, and oil absorption capacity (Glencross et al., 2007).

In order to assess the effect of a novel ingredient on final pellet quality, test extrusion/pelleting can be carried out. In this type of study, a hypothetical formulation using the test ingredient is run through an extruder or pellet mill and the properties of the pellets produced are compared with either a reference formulation or a series of target specifications as described above (i.e., density, hardness, sinking rate, water stability, etc.).

The effect of the ingredient on the pellet quality is also important to consider for environmental sustainability and logistical reasons. The ingredients and pellet quality can affect waste output of aquaculture operations.

For example, ingredients may affect fecal stability in different ways which will have an impact on the release of wastes into the environment.

Moreover, the digestibility of the ingredient will have a determinant impact on solid waste output. In terms of logistics, feed must be stable during storage, transport, and handling.



# Step 7

## Value your product

An economic valuation of your product is another critical step in the process of bringing it to market.

It is important to price your ingredient competitively so that it is a viable option for feed formulators and manufacturers to include in aquaculture feeds.

It is no longer wise to set the price of your ingredient based on the price of a single raw material such as fish meal, for example.

Feed manufactures are using advanced feed formulation programs that allow for the optimization of feed formulations that choose ingredients based on the price per unit of a nutrient, and not per unit of ingredient.

So, during the evaluation of a new feed ingredient, or updated ingredient pricing, feed manufacturers will perform a process known as shadow pricing that indicates how much the cost of an ingredient will have to fall before it can be included in the formula.

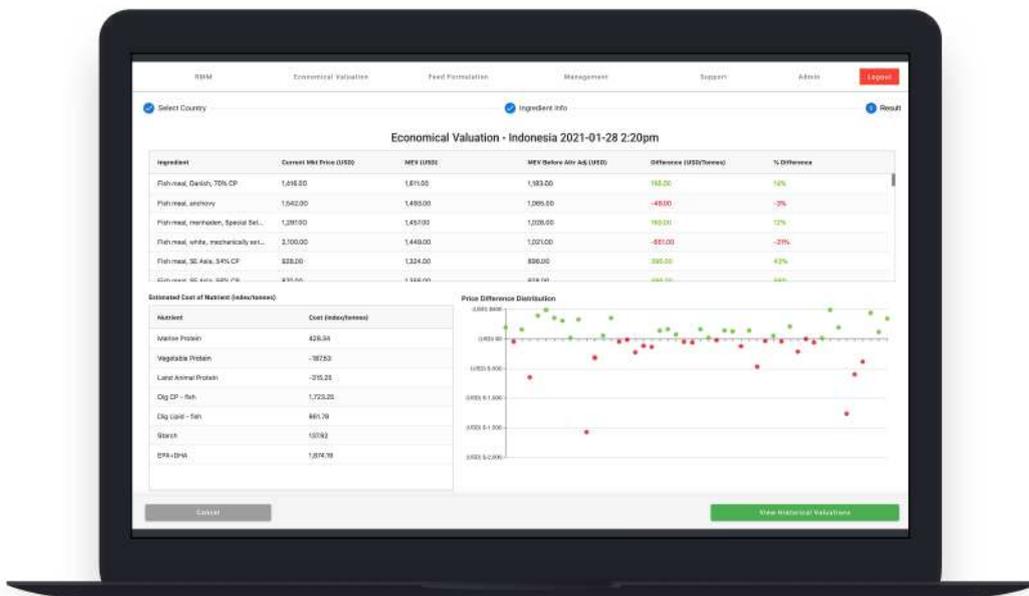
This cost change is called the marginal price change of the ingredient. These exercises are performed with feed formulation programs, formulating feeds on a least-cost basis, and are dependent on the nutrient profile of the feed, nutrient restrictions and the nutrient profile of the ingredients.

Wittaya Aqua recommends using its Economic Valuation Tool (EVT) available in the AquaOp Feed platform.

The EVT estimates the economic value (fair market price) of ingredients based on current prices of other ingredients in the market(s) of interest, their nutritional composition (digestible protein, crude lipids, etc.) and a series of “attributes” that alter the “value” of an ingredient such as the origin of the digestible protein (marine, terrestrial, vegetable), etc.

The EVT is used to provide a more holistic estimate of the economic value of the product compared to other aquafeed ingredients for various species and countries.

<https://wittaya-aqua.ca/feed.html>



# Step 8

## Acquire regulatory approval or ensure compliance for your product

When developing an ingredient, it is important to consider the regulatory framework in which the ingredient will need to be approved. This framework will vary between countries; therefore, you must exercise due diligence in researching the necessary procedures to register your ingredient with the proper authorities.

Wittaya Aqua maintains relationships with a network of individuals and organizations in various countries and may be able to assist you in registering your product if required.

In Canada for example, the Canadian Food Inspection Agency (CFIA) is responsible for the regulation of new feed ingredients. Under the Feeds Act and the Health of Animals Act, the CFIA administers a national feed program.

There are two key components: mandatory pre-market assessment and the National Feed Inspection Program.

The pre-market assessment consists of two elements, namely the assessment of new ingredients for approval/authorization and product registration. Any feed ingredient that is new (i.e., not already listed in Schedules IV and V of the Feeds Regulations) or has been modified such that it differs significantly from a conventional ingredient is required to undergo a pre-market assessment and approval.

The purpose of the feed assessment is to verify that the feed ingredient is safe (in terms of animal and human health and the environment) and effective for its intended use prior to marketing.

A risk assessment framework is a key component of the safety and efficacy assessment. For more information on the regulatory process for feed ingredients in Canada, see the link provided below.

<https://inspection.canada.ca/animal-health/livestock-feeds/regulatory-guidance/rg-1/eng/1329109265932/1329109385432#intro-13>

The Food and Drug Administration (FDA) regulates animal feed in the United States. The FDA and the Association of American Feed Control Officials (AAFCO) work together in the area of animal food regulation, particularly in the establishment of definitions to describe new feed ingredients.

The FDA cooperates with AAFCO and the States for implementation of uniform policies for regulating the use of animal food products including proper labeling to ensure safe use of animal feeds.

Under the FDA, the use of food products, including animal feed ingredients, is governed by the provisions of the Federal Food, Drug, and Cosmetic Act.

The FDA's Center for Veterinary Medicine (CVM) is responsible for the regulation of animal food (feed) products. Legally, under the Federal Food, Drug, and Cosmetic Act, any substance added or expected to become a component of animal feed must be used in accordance with a food additive regulation unless it is Generally Recognized as Safe (GRAS) for that use.

Typical animal feed ingredients such as forages, grains, and most minerals and vitamins are GRAS as sources of nutrients. For more information on the regulatory process for feed ingredients in the United States, see the links provided below.

<https://www.fda.gov/animal-veterinary/animal-health-literacy/animal-feed-regulations>

<https://www.fda.gov/animal-veterinary/animal-food-feeds/ingredients-additives>

<https://www.fda.gov/animal-veterinary/animal-food-feeds/product-regulation>



# Step 9

## Determine if there are any religious or cultural issues preventing your product from going to market in certain regions

In addition to ensuring that your ingredient complies with regulatory requirements, it is essential to investigate any issues of religious or cultural acceptance that could prevent your product from being marketable in certain regions. Religious exclusion of ingredients from a particular market may be a result of the methods used to manufacture/prepare that ingredient or the type of ingredient itself (i.e., animal by-products, GMOs).

For example, in some regions of the Middle East and Southeast Asia that are predominantly Muslim there may be a demand for your feed ingredient to be certified Halal. Likewise, Kosher feed ingredients conforming to Jewish dietary regulations may result in exclusion of certain ingredients from particular markets.

Cultural issues may also affect the ability to enter certain markets. Language may be a barrier to marketing your ingredient in a particular country or region. A translator could be needed to translate product information and specifications and to accompany sales personnel into the region.

Cultural customs and norms of a particular region may affect how business is conducted and this could impact your ability to successfully sell your ingredient in some countries/regions. An understanding of how business is carried out in particular regions is a huge asset. Hiring sales and technical staff in the region(s) you intend to market your product may be necessary depending on the scale of your operation.

# Step 10

## Know your competitors

Knowing your competitors is key to successfully bringing your ingredient to market in a sustainable and profitable way. You must know your competitors' products and the value of those products in order to remain relevant in the market. Learning about your ingredient in relation to your competition will broaden your knowledge about your target market(s) and allow you to refine your business strategy. Moreover, knowing the companies that have a share of the market you are interested in is part of risk mitigation. Some considerations and questions to think about when learning about your competitors include:

- What differentiates your product from that of your competitors?
- What are your competitors' strengths?
- What are your competitors' weaknesses?
- Understand your competitors' pricing
- What kind of competitors do you have?
  - » Direct competitor: offers the same product or service and competes in the same market.
  - » Indirect competitor: offers a different product or service and competes in the same market to satisfy similar customer needs.

# Wittaya Aqua

Wittaya Aqua International is a Canadian-based company specializing in the development of software solutions for the global aquaculture industry. We provide a range of services to clients from bespoke consulting services and R&D support to cloud-based software products. We offer two software platforms: AquaOp Farm and AquaOp Feed.

AquaOp Farm is a cloud-based farm management platform that allows farms to manage their operations more effectively. Farmers can use the platform to forecast, track, visualize, and analyze key aspects of their operations, enabling them to make data-driven decisions in real-time and helping them to run their farms more efficiently, profitably, and sustainably.

AquaOp Feed, also cloud-based, provides aquafeed manufacturers and ingredient suppliers with innovative tools for managing raw materials, formulating feeds, finding value in global aquaculture markets, and much more. AquaOp Feed comes fully loaded with commercially relevant nutritional specifications for over 30 species and country-specific feed ingredient databases for key global aquaculture markets.



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