

## **Project Proposals for the RCA Programme 2020/2021 2<sup>nd</sup> Round Project Concept Template**

### **Part 1: Information Sheet**

Project proposals for the RCA Programme 2020/2021 are to be prepared using the attached template. Completed templates will be reviewed by the RCA PAC at the Meeting in Vienna being held 28 January to 2 February 2018.

- **PLEASE NOTE THAT ALL PROSPECTIVE CONCEPTS REQUIRE INFORMATION THAT IS LODGED ON THE RCARO WEBSITE** (access is only required to the RCA information not the whole Members Only site).
- **YOU WILL HAVE TO APPLY FOR A PASSWORD AND ACCESS CODE TO ENABLE ACCESS TO THIS INFORMATION.**

**PLEASE GET ENDORSEMENT FROM YOUR NATIONAL REPRESENTATIVE FOR THIS ACCESS.**

The 2<sup>nd</sup> Round Concept Proposals will be evaluated against the response to the feedback you have received from RCA PAC on your 1<sup>st</sup> Round Concept Proposals as well as the criteria listed below:

- **Is its aims and objectives in line with priorities set out the RCA Medium Term Strategy for 2018/2023?**

Yes, it is.

- **Identify which elements of the MTS are being complied with.**

The proposed project aligns well in all regional strategic priorities in period 2018-2023 relating to increase agricultural production, productivity and quality of animal commodities through sustainable use of available resources, contribute towards better adaptation to human activity and climate change by strengthening resilience to external and climate shocks such as natural disasters, facilitate global trade in food through the applications of nuclear science and technology that may contribute to regionally harmonized regulatory systems and enhance food safety and security.

- **Why it should be a regional project.**

The project proposal should be a regional project because through the project, countries in the region will strengthen cooperation in the development of sustainable aquaculture industry by limiting the use of antibiotics and replacing them with biological stimulants to promote the growth, immune system and physiological health of fish and shrimp.

- **The essential role of the nuclear technology in the project.**

As compared to non-nuclear techniques, the application of radiation processing technology to prepare oligosaccharides and nanoparticles has some advantages due to several reasons, for instance: 1) the reaction is carried out at room temperature; 2) yield of oligosaccharides and nanoparticles is high; 3) products can be purely prepared without contamination of excessive chemical reductant and chemical residue; 4) for the formation of nanoparticles, the size of nanoparticles is easily controlled



by changing metal ions precursor and stabilizers concentration, dose, dose rate or seed enlargement approach; and 5) mass production can be carried out in line with requirements of clean production.

➤ **Does the proposal identify links to previous projects in this area of technology?**

No, this is the first project studying on effects of oligosaccharides and hybrid oligosaccharide/nano material prepared by radiation technology on growth, innate immunity and disease resistance of fish in aquaculture

➤ **Does the proposal overlap or duplicate current or previous RCA projects?**

The proposal does not overlap or duplicate current or previous RCA projects

➤ **Is a convincing case made to justify further projects in this area?**

Yes

➤ **Is there a strong TCDC component to exploit the benefits from the earlier projects?**

No, this is first project in past RCA projects

➤ **Is there a readily available baseline against which to measure the effectiveness of the project?**

Yes

➤ **If the proposal is essentially an extension of previous projects in this area that have been implemented for more than 2 TC Cycles, does the proposal include arrangements for the transfer of project leadership to others?**

No

**In addition to the above, please address the following specific questions:**

Was this concept identified at the 46 <sup>th</sup> RCA GCM as requiring merger with other similar concepts?	NO.
If "YES" – was this concept prepared as a result of consultation with the other proposers?	NO.
If "NO" - why was this not undertaken?	This is first project in past RCA projects.



## Part 2: Concept Template

### **Title:**

- *The title should be as concise as possible and should summarize the objective of the project.*

**Applying radiation technology to prepare natural bio-immunostimulants in aquaculture (fish and shrimp) in RCA region.**

### **Compliance with the RCA Medium Term Strategy for 2018/2023:**

*All RCA projects have to comply with the RCA MTS for 2018/2023 - please refer to the MTS document.*

- *Briefly indicate to which specific MTS priorities this project proposal contributes.*

Aquaculture is rapidly developing in many countries in the world such as China, India, Japan, Korea,.. However, intensive culture, infectious disease and adverse environmental condition are major impediments to the development of aquaculture leading to production and economic loss. Therefore, this project proposal will contribute an alternative and environmentally friendly method for prevention and disease management by using oligosaccharides (oligochitosan, oligobetaglucan,..) especially hybrid oligosaccharides combine with nanomaterial as immunostimulants to increase the non-specific immune response, activate the specific defence mechanism and growth performance in aquaculture, which, sequentially, improves the productivity and capability of adapting to climate change of aquacultural products.

*How will these be achieved?*

Oligosaccharide and hybrid oligosaccharide/nano material were prepared by radiation technology for aquaculture. Radiation method ( $\gamma$ -ray, electron beam) has been considered as a useful tool for degradation of polysaccharides and also synthesis nanomaterial from the viewpoint of environmentally friendly processing method and large scale production. The project proposal will enhance the regional capacity in developing sustainable aquaculture by increasing production, productivity and quality in aquaculture through using oligosaccharide and hybrid oligosaccharide/nano material prepared by radiation technology.

### **Overall Objective:**

- *State the objective to which the project will contribute. (Note this has to be in line with the RCA MTS for 2018/2023. It should be a short description expressed as: To do ... ..)*

To increase aquacultural products' innate immunity, disease resistance and growth performance using natural bio-immunostimulants processed by radiation technology

### **Proposed Participating Government Parties:**

- *List the Government Parties expected to participate in the project.*

China  
Indonesia  
Malaysia  
Pakistan  
Philippine  
Thailand  
Australia  
India  
Japan  
Republic of Korea



New Zealand  
Singapore  
Sri Lanka  
Myanmar  
Laos  
Cambodia

*Indicate each of those where you have baseline information on their requirements and needs:*

China, Indonesia, India, Japan are countries having a developmental aquaculture. Intensive culture, infectious disease and adverse environmental condition are major impediments to the development of aquaculture leading to production and economic loss. Therefore, using oligosaccharide and hybrid oligosaccharide/nano material prepared by radiation technology to replace antibiotic in aquaculture is very necessary.

#### **Technical Cooperation among Developing Countries (TCDC) Project Component:**

*Review the documentation on line – [www.rcaro.org/](http://www.rcaro.org/) ???.*

- *Outline the TCDC strategies to be used in the project to enhance regional cooperation:*

The proposed project align well with all regional strategic priorities in period 2018-2023 relating to increase agricultural production, productivity and quality of animal commodities through sustainable use of available resources, contribute towards better adaptation to human activity and climate change by strengthening resilience to external and climate shocks such as natural disasters, facilitate global trade in food through the applications of nuclear science and technology that may contribute to regionally harmonized regulatory systems and enhance food safety and security. The project also addresses the aquaculture priorities through i) to increase aquaculture production, productivity and quality of fish through sustainable use of available resources; ii) to contribute an alternative method for prevention and disease management in aquaculture iii) to replace antibiotics and chemotherapeutic agents, increasing the attention of farmers is being paid to the use of immunostimulants for disease control measures in aquaculture.

- *Will the project design feature partnering arrangements between those advanced and those less advanced in the technology?*

During the course of the project, the training courses or workshops will be held for partners to share experiences as well as the knowledge of science and technology from countries having competence in the technology.

- *If so, list those expected partnerships.*

China  
Indonesia  
Thailand  
India  
Japan  
Republic of Korea  
New Zealand

#### **Analysis of gaps / problems / needs as applied to the RCA region:**

- *Outline the major gaps / problems/specific needs to be addressed by the project (~ 300 words):*

Aquaculture is the major food producing sector of agriculture in the world. The contribution of aquaculture to fish production is steadily increasing every year. World per capita apparent fish consumption increased from an average of 9.9 kg in the 1960s to 14.4 kg in the 1990s and 20 kg in 2015. However, the development and expansion of the culture industry and increasing demand of fish and shellfish production further prompt intensive fish and shellfish culture. This type of practice creates highly stressful environment for fish that further suppress the immune respond and outbreak of infection. Diseases are major bottlenecks



in the development and sustainable of aquaculture practices. Infectious disease is the most significant factor causing of economic loss. Vaccination may be the most effective method of controlling fish disease, even though some diseases have not been control by vaccination due to their heterogeneity such as diseases caused by bacteria like *Aeromonas hydrophila*. Traditional disease control strategies in aquaculture include the use of antibiotic and chemical disinfectants, but they are no longer recommended due to the emergence of resistant bacterial strain, problems associated with drug residues in cultured fish and accumulation of residues in the environment. Therefore, it is necessary to find an alternative method to effectively manage and control the disease without harming the environment and human. One of the most promising methods to preventing and controlling the disease in aquaculture conducted through this project is the strengthening the defense mechanism of fish through prior administration of natural immunostimulants deriving from natural polysaccharides and hybrid oligosaccharide/nano material prepared by radiation technology.

- *Review the resource documentation and list any past RCA projects that have addressed similar problems/needs in this area of technology.*

This project is aimed at popularizing bio-immunostimulants, which is superior to traditional methods (antibiotics and chemical disinfectants) in terms of efficiency, effects on environment and human health.

- *What are the major additional capabilities/skills in this area of technology that will be provided through this project (~ 200 words).*

Currently many commercial polysaccharides are available in the fish aquaculture industry and are extensively used as immunostimulants to induce and build up protection against a wide range of diseases, including  $\beta$ -glucan, chitosan, raffinose, fucoidan, carrageenan,... . However, polysaccharides have several drawbacks to be utilized in biological application, including poor solubility under physiological functions. Therefore, a new interest has recently been emerged on oligosaccharides with higher activity and more physiological functions than polysaccharides. In addition, nanotechnology also can be used for improving the physiological and biochemical status of fish and fisheries and the aquaculture industry can be advanced by the use of nanoparticles of micronutrient. Selenium is an important dietary micronutrient and improves the growth, immune system and physiological health of fish. When delivered in nanoform, selenium is of lower toxicity and higher efficiency compared to sodium selenite or selenomethionine. Therefore, the major additional capabilities that will be provided through this project are:

1. Capacity on the use and application of nuclear technique for preparing oligosaccharides and nanoparticles
2. Capacity to prevention and controlling the disease in aquaculture
3. Capacity to improve growth, immune system and health of fish
4. Capacity to manage the quality of fish and environment in aquaculture

#### **Requirements for participation:**

- *Indicate the minimum requirements that the counterpart institutions in Government Parties would need to meet in order to participate in this project.*
- Have an aquaculture and want to develop a sustainable aquaculture
- Have irradiation facilities to prepare oligosaccharides and nanoparticles
- Have plentiful and abundant polysaccharides source
- *Indicate the status of expected participating Government Parties as "Resource" or "Recipient".*

#### **Stakeholder analysis and partnerships:**

- *Briefly describe who are expected to be the principal beneficiaries of this project and any role that will be defined for them in the project.*
- Farmers will get higher profit when using oligosaccharide and hybrid oligosaccharide/nano material because of the increase of survival rate, growth performance of fish and shrimp fed with oligosaccharide and hybrid oligosaccharide/nano material.
- Farmers using oligosaccharide and hybrid oligosaccharide/nano material replaced antibiotic will increase



the quality of fish and shrimp.

- Aquatic specialists and managers of aquatic environment and diseases have an alternative and environmentally friendly method for prevention and disease management.

- *Have any extrabudgetary funding possibilities, sponsors and partners been identified?*

This project currently has not any extrabudgetary funding or sponsors yet.

- *Have any sponsors/partners been involved at the concept stage?*

This project currently has not any sponsors/partners been involved at the concept stage yet.

- *Have any sponsors/partners made firm commitments of support at this stage?*

This project currently has not any sponsors/partners made firm commitments of support at this stage yet

- *Have any sponsors/partners expressed firm commitments to extrabudgetary support?*

This project currently has not any sponsors/partners expressed firm commitments to extrabudgetary support yet.

### **Role of nuclear technology:**

- *Indicate the essential nuclear technique that is planned be used in this project.*

The oligosaccharides and nanoparticles can be used as an immunostimulants in aquaculture because they can improve the innate defence of fish providing resistance to pathogens during periods of high stress. In addition, oligosaccharides have biocompatible, biodegradable and environmental friendly properties. These substances have not shown any of the negative side effects that antibiotics and live vaccines may have on the consumers and on the environment. However, the preparation of oligosaccharides and nanoparticles by chemical method or some other methods can produce impure products having residues of toxic chemicals by the use of chemical degradation and reductant. Thus for the purpose to develop a safe and sustainable aquaculture industry, the application of radiation processing technology (electron beam and gamma Co-60) for degradation of natural polysaccharides to produce oligosaccharides and also synthesis nanopartilces is very essential and suitable due to high purity of products.

- *Outline why it is suitable for addressing the problems/needs in question.*

For this project, nuclear techniques are the best such as to prepare oligosaccharides and nanoparticles from the viewpoint of environmentally friendly processing method and large scale production.

- *Is this the only available technique?*

Oligochitosan and hybrid oligosaccharide/nano material can be prepared by chemical or biological method.

- *Does it have a comparative advantage over non-nuclear techniques?*

As compared to the non-nuclear techniques, the application of radiation processing technology to prepare oligosaccharides and nanoparticles has some advantages due to several reasons, for instance: 1) the reaction is carried out at room temperature; 2) yield of oligosaccharides and nanoparticles is high; 3) products can be purely prepared without contamination of excessive chemical reductant and chemical residue; 4) for the formation of nanoparticles, the size of nanoparticles is easily controlled by changing metal ions precursor and stabilizers concentration, dose, dose rate or seed enlargement approach; and 5) mass production can be carried out and satisfying to requirements of clean production.

### **Duration of the project:**

- *Indicate the number of years estimated to be required to complete the project.*

The project will be implemented over 4 years

Expected Duration: 2018 - 2021

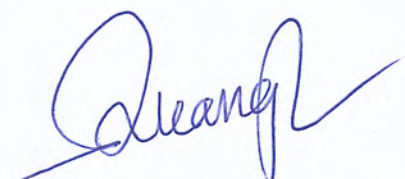


**Part 3: National Representative Endorsement for Project Concept**

**I have endorsed the proposer to have access to the RCARO web page for the resource documentation necessary to complete the attached concept document.**

**This 2<sup>nd</sup> Round Concept meets the RCA project requirements and I endorse it as a priority for the RCA Programme 2020/2021.**

**Signed:**

A handwritten signature in blue ink, appearing to read 'Quang', with a stylized flourish extending to the right.

**PhD. Nguyen Hao Quang**  
**National RCA Representative of Vietnam**

**Date: 12 January 2018**