SINGAPORE FOOD STORY (SFS) R&D PROGRAMME 2.0

FOOD SAFETY MAIN GRANT

CALL FOR PROPOSALS - INFOSHEET

SFS R&D Programme Office (SFA):

Singapore Food Agency
Science and Technology Division
Research Planning Department
52 Jurong Gateway Road, #14-01
Singapore 608550
E-mail: SFA_RND@sfa.gov.sg

1. BACKGROUND

1.1. Singapore imports more than 90% of its food, making us vulnerable to food supply and safety risks, such as disease outbreaks, geopolitical disruptions, and climate change.

1.2. To secure a supply of safe food in Singapore, the Singapore Food Agency (SFA) has been working closely with the ecosystem to build the agri-food industry's capability and capacity to produce 30% of Singapore's nutritional needs locally and sustainably.

1.3. The Singapore Food Story (SFS) R&D Programme was initiated in 2019 to drive research in four domains of (i) AquaPolis (Aquaculture); (ii) Sustainable Urban Agriculture; (iii) Future Foods; and (iv) Food Safety.

1.4. Food toxicology involves the detection of toxic substances in food and characterisation of their associated health effects. By reviewing toxicological data, independent scientific expert committees such as the Joint Food and Agriculture Organization of the United Nations (FAO)/World Health Organization (WHO) Expert Committee on Food Additives (JECFA) and Joint FAO/WHO Meeting on Pesticide Residues (JMPR) conduct risk assessments and set regulatory limits for chemical food hazards.

1.5. While animal testing is the current gold standard in toxicity testing, there are limitations in translation to human toxicity assessment, as well as a global shift away from animal testing towards New Approach Methodologies (NAMs) that reduce or eliminate the need for animal testing.

1.6. Following the European Union (EU)'s landmark ban on the use of animals for cosmetic toxicity testing in 2013, which in turn encouraged the adoption of *in vitro* and *in silico* NAMs by the global cosmetic industry, food regulatory agencies worldwide are increasingly recognising the potential of NAMs to enhance the toxicity and risk assessment of food-related substances.

1.7. Currently, various global regulatory agencies such as the U.S. Food and Drug Administration (FDA), European Food Safety Authority (EFSA), China National Centre for Food Safety Risk Assessment (CFSA) and South Korea's Ministry of Food and Drug Safety (MFDS) have initiated NAMs activities. These activities include roadmaps to advance the science, validation and application of NAMs, with the key outcome of improving the accuracy and efficiency of safety evaluations and fostering food innovation while reducing reliance on animal testing.

1.8. The development and validation of NAMs is required for incorporation into a Next Generation Risk Assessment (NGRA) framework, which is a modular and tiered approach incorporating different combinations of NAMs for an exposure-led and hypothesis-driven chemical risk assessment (Annex 1).

1.9. To enhance the protection of Singaporean consumers' health, Singapore is strengthening its capability in the development and validation of NAMs preferably for the Asian phenotype and evaluation of NAMs and NAMs-derived data for comprehensive toxicological assessments.

2. OBJECTIVES OF THE FOOD SAFETY MAIN GRANT

2.1. This grant call serves to support R&D proposals to achieve mid Technology Readiness Levels (TRL[1]), and improve regulatory efforts to detect and predict the evolving threat of new chemical food hazards through the development of tools and platforms that could fit into the next generation risk assessment of emerging food toxicants.

2.2. The validated NAMs developed from the SFS 2.0 grant call are intended to contribute towards the development of proof-of-concept studies for the combination of different NAMs to build a unique NGRA framework for Singapore, based on the Asian phenotype, under potential future R&D grants.

3. SCOPE OF GRANT CALL

3.1. This grant call supports R&D proposals which demonstrate strong innovation potential to achieve mid-Technology Readiness Levels (TRL). Applicants shall address the following challenge statements (refer to Table 1) in their Research Proposals.

Table 1: Challenge Statements

Food Safety Theme	**Challenge Statement / Desired Research Outcomes**
Development of non-animal new approach methodologies (NAMs) for toxicological evaluation of food innovations	Develop validated non-animal NAM-based tools and platforms, preferably of the Asian phenotype**,** to assess and/or predict the toxicity of chemical food hazards, especially in cell-based food and fermentation-derived food products* and on at least two organ systems of concern from a food safety perspective, which may include, but are not limited to the: • Development of validated 3D organ models (e.g. organoids, tissue/organ-on-chip) for toxicity evaluation of food compounds • Use of validated *in silico* models such as physiologically based kinetic (PBK) modelling for quantitative *in vitro*-to-*in vivo* extrapolation (QIVIVE) or assessing and/or predicting toxicokinetic parameters for food toxicants • Development of quantitative structure–activity relationship (QSAR) and read-across approaches to predict toxicity • Use of high-throughput omics (e.g. toxicogenomics, toxicoproteomics, toxicometabolomics) technologies and reporter assays for interrogation of adverse outcome pathways • Use of high-content imaging and/or phenotypic profiling assays to differentiate adverse responses from adaptive biological changes

* Cell-based food refers to cell-cultured or cultivated meat and fermentation-derived food products may include alternative proteins produced using precision fermentation and biomass fermentation.

3.2 Projects are to:

- Develop and validate *in vitro*, *in silico* or *in chemico* NAMs, preferably of the Asian phenotype, to evaluate food toxicity on at least two organ systems of concern, which may include, but are not limited to the **liver, nervous system, developmental and**

[1] Technology Readiness Level ("TRL") is a scheme to assess the maturity of technologies.

reproductive system, immune and endocrine system and cardiovascular system.

- Refer to international guidelines such as the Organisation for Economic Co-operation and Development (OECD) Guidance Document No. 34 on the Validation and International Acceptance of New or Updated Test Methods for Hazard Assessment for the validation of the NAMs developed.
- Include validation experiments to demonstrate: (a) accuracy (e.g. sensitivity and specificity), and (b) reliability (intra-laboratory repeatability and intra-/inter-laboratory reproducibility) of the developed model(s) using reference compounds (toxicants and non-toxicants) that have existing animal or human data. Researchers may refer to published organ-specific reference compound lists that are relevant to the NAMs being developed such as the drug-induced liver injury severity and toxicity (DILIst) and drug-induced cardiotoxicity rank (DICTrank) datasets by the U.S. Food and Drug Administration (FDA).
- Provide a detailed assessment and demonstrate at least 20-30% improvement in performance (e.g. throughput/time, cost savings, accuracy or reliability) compared to animal testing or existing test methods/kits available at the end of the funding period. Researchers may refer to baseline figures for the cost of animal testing in selected toxicology assessments (Annex 2). Alternatively, comparisons of performance can also be made with test kits/models from commercial vendors or toxicology testing services offered by public and contract research organisations (CROs) (Annex 3).
- Include a proof-of-concept study to demonstrate use of the developed NAMs for evaluating the safety of at least one chemical food hazard, especially in cell-based food or fermentation-derived food products, for which some examples of relevant chemical hazard classes can be found in Annex 4.
- Consider how the model developed and/or data collected could be made relevant to or be extrapolated to account for differences in the Asian phenotype or physiology, if non-Asian cell lines are used.

3.3. Research Proposals shall demonstrate strong potential for innovation, proof of concept and eventually, real-world application within and beyond Singapore. Applicants shall clearly articulate the levels of improvement and how the proposed research will contribute to achieving the specified desired outcomes. These improvements will need to be compared with the global best-in-class technologies or solutions that are already available in the market. The target TRL at the end of the project is expected to be higher than the entry TRL specified in the Research Proposal, and the target end TRL should be ≥ 4.

3.4. Research Proposals shall clearly articulate how the projects can value-add to research capabilities in the local context, which includes, but is **not limited to**, plans for scientific publications in international journals, intellectual property generation, collaboration with industries to advance research outcomes/solutions.

3.5. Research Proposals could include identified relevant industry partners, if any, clearly indicating their roles, scope of work and contributions to the project if awarded. This could be through the provision of Letters of Support from industry partners during proposal submission followed by Research Collaboration Agreements (RCAs) after award. Contributions include cash, in-kind services, or a combination of the two towards the project. In-kind services can include labour, materials, and other services.

3.6. There is no required Industry R&D Spending[2] (IRS). However, research Proposals with identified relevant industry partners shall include Key Performance Indicators[3] such as Industry R&D Spending[2] (IRS) and the number of technologies deployed, including licenses[4].

3.7. Funding support for each Research Proposal awarded, based on merits, shall be up to a quantum of **S$3 million** for **a period of up to three years**. Proposals with a funding quantum and/or project length that exceed(s) these limits may be considered, although strong justifications will be required.

3.8. Cross-disciplinary/multi-disciplinary Proposals, are strongly encouraged. Applicants are also strongly encouraged to collaborate with foreign organisations and experts, especially in areas with potential for introduction of new research capabilities and transfer of technical expertise into Singapore.

4. ELIGIBILITY, FUNDING SUPPORT & OTHER IMPORTANT INFORMATION

4.1. Principal Investigators (PI) from all Singapore-based institutions of higher learning (IHLs), public sector agencies and private sector entities, are eligible to apply.

4.2. Singapore-based IHLs and public sector agencies will qualify for up to 100 percent of the approved qualifying direct costs[5] of a project.

4.3. Funding for private sector entities for research projects would be conditional on collaboration with a public research performer.

4.4. Tiered funding support levels would apply (up to 30% for all non-Singaporean entities; 50% for Singaporean Large Local Enterprises; 70% for Singaporean Small and Medium sized Enterprises, start-ups, and not-for-profits).

4.5. Support for indirect costs[6] of research may be provided, only for Singapore-based IHLs and public sector agencies. Funding support of up to 30 percent of the total qualifying approved direct costs (i.e., total direct costs less exceptional items) will be

[2] This refers to the R&D investment that a company commits to spend in Singapore as a result of collaborations with a public research performer. The R&D investment can comprise cash and/or in-kind. The investment can fund (i) the R&D project performed at public sector entity(s); and/or (ii) the company's own research operations in Singapore related to the public-sector R&D collaboration. The investment by the company, whether in cash or in qualifying in-kind contributions should, where possible, be reflected in the agreements signed between the company and the relevant performer(s).

[3] Additional KPIs and Tracking Indicators (TIs) may be set at project level for tracking of outcomes.

[4] This measures the number of research findings or technologies developed that are deployed (e.g., through a license or at least at pilot scale) that will contribute to at least one of the following outcomes: i) Introduction of new product in the market, ii) Introduction of new service in the market, iii) Product or process improvement. This should be tracked by type of company (MNCs, LLEs, SMEs, start-ups and public sector/VWOs).

[5] More information on the non-fundable direct costs of research can be found in Appendix I.

[6] Indirect costs in research are those costs that are incurred for common or joint objectives and therefore cannot be identified readily and specifically with a particular sponsored research project, but contribute to the ability of the Institutions to support such research projects (e.g. providing research space, research administration, utilities), and not through the actual performance of activities under the sponsored research projects.

allowed. This is subject to the approval from SFA. Host Institutions will be responsible for administering and managing the support provided for the indirect costs of research.

4.6. All projected output and achievements of the proposed research are expected to be commensurate with the level of funding requested.

4.7. Research Proposals already funded by other agencies or are being considered for funding by other agencies will not be considered under the present call. PIs will need to declare other funding sources during the application.

4.8. The Lead PI must be based in Singapore[7]. All funding awarded must be used to carry out the research and innovation activities in Singapore unless approved in the grant.

4.9. Collaboration with foreign organisations and experts in the capacity of Co-Principal Investigator (Co-PI), or as Collaborator is allowed. However, contracting out the whole or substantial part of the research work is not permitted.

4.10. Collaborators are not permitted to receive, directly or indirectly, any part of the funding, whether in cash or in the form of assets acquired using the funding or otherwise. All assets acquired using the funding must be located in Singapore and maintained within the control of the grantees.

4.11. Urban Solutions and Sustainability (USS) domain agencies have compiled a metadata catalogue to improve data discoverability for researchers. It seeks to encourage early (i.e. pre-award) data-related discussions between Lead agencies and Investigators and will serve as a central reference for datasets available within agencies for request.

4.12. Interested Investigators from:
• Public Institutions (i.e. AUs, polys, A*STAR Research Entities, and Temasek Life Sci Lab) may approach your respective Research Offices, who will assist to write in to request for the metadata catalogue.
• Local Entities (that are not part of the list of public institutions) may write in to request for the metadata catalogue directly. If approved, an authorised signatory from the organisation must agree to a non-disclosure undertaking before the metadata catalogue is shared.

4.13. Agencies will assess the requests based on the grant call topic (e.g. if sharing of agencies' data is indeed useful given the nature of the topic) and may request for further substantiations. Please note that agencies reserve the right to approve/deny any requests for the metadata catalogue, and that any data subsequently requested from the Government and/or public agencies will require the signing of separate non-disclosure agreements (NDA).

5. APPLICATION

[7] Lead PIs must have a minimum of 9 months employment with a Singapore-based organisation (Singapore-based institutions of higher learning (IHLs), public sector agencies, not-for profit research laboratories as well as companies and company-affiliated research laboratories/institutions), and fulfil at least 6 months of residency in Singapore over a period of 1 calendar year.

5.1. This call for proposals involves a single full proposal stage.

5.2. The Lead PI is required to submit an online application via the Integrated Grant Management System (IGMS). Separate submissions outside of IGMS will not be considered. Once PIs have submitted their documents online, their applications will be routed to the Director of Research (or equivalent) of their respective Host Institution for online endorsement.

5.3. Please refer to the manuals and training guides from the Integrated Grant Management System (IGMS) at https://www.researchgrant.gov.sg/Pages/faqs.aspx for all instructions and guidelines on the submission process.

5.4. It is mandatory for applications to be lodged in the IGMS system and endorsed by the Host Institution by **6 March 2025, 1200hrs, Singapore time (UTC +8:00)**. Late submissions or submissions without endorsement from the Host Institution will not be entertained.

5.5. Applications are complete only if all relevant documents are submitted. The Research Administrative Office from IHLs or equivalent outfits in companies are required to ensure information submitted by their researchers for the grant call are compiled according to the requirements set out. Incomplete submissions will be rejected.

5.6. The application documents required for the submission can be downloaded from the 'Research Proposal' section of the IGMS website. Completed documents should be uploaded in the IGMS website.

5.7. SFA is currently utilising Robotic Process Automation (RPA) to extract information from submitted Research Proposals. Please submit your proposal in MS Word format and do not alter the format within the proposal template. Please be advised that failure to adhere to the provided instructions may lead to the rejection of your proposal.

5.8. The following documents are required for the submission. It is advised to restrict the total attachment size to be less than 25MB. Please follow the naming convention and format for labelling of soft copy attachments:

Attachment	**Naming Convention**	**Format**
Research Proposal	RP_ *Project title*	MS Word
Annex A – Curriculum Vitae	CV_ *Project title*	PDF
Annex B – Detailed Project Budget	Budget_ *Project title*	MS Excel
Annex C – Detailed Methodology	Methodology_ *Project title*	PDF
Annex D – Letters of Support	LOS_ *Project title*	PDF
Annex E – Suggested Peer Reviewers	SPR_ *Project title*	PDF
One-Slide Summary (NABC model)	Summary_ *Project title*	PDF

5.9. Content for the research proposal (excluding up to 4 pages for Detailed Methodology in Annex C) must not exceed 10 pages and must be written in Arial font size 12-point

with single line spacing. Refer to the research proposal template for more specific details.

5.10. In case of discrepancy between the information in the IGMS application form and the attachments uploaded, the information in the attachments shall be taken as final.

5.11. Applicants are to note that **where relevant privileged or confidential information is needed to help convey a better understanding of the project, such information should be disclosed and must be clearly marked in the proposal.**

6. SELECTION PROCESS AND AWARD

6.1. All endorsed proposal(s) eligible for funding will be subjected to a round of Peer Reviews, followed by evaluation by a Project Evaluation Panel. Where appropriate, proposals may also be sent to industry resource persons and relevant national agencies for additional review. All information needed for a proper and complete evaluation should therefore be included in the application.

6.2. Proposals will be evaluated based on the following broad criteria:

a) Potential Contribution to Grant Objectives
   i. *Relevance and amount of contribution of proposed research in addressing the challenge(s) posed.*

b) Scientific Excellence and Innovation Potential
   i. *Quality and significance of proposed research, including the potential for breakthrough/innovation to advance knowledge and understanding within its own field or across different fields.*

c) Potential for Commercialisation, Application & Deployment in Singapore and Beyond
   i. *Potential for application of research outcomes/solutions within and beyond Singapore.*
   ii. *Feasibility for commercialisation of research outcomes/solutions*

d) Execution Strength and Technical Competency of Research Team
   i. *Quality of plans for execution and delivery of the research programme and goals, including the appropriateness of the proposed milestones, deliverables and reasonableness of the budget.*
   ii. *Quality, significance, and relevance of the recent research record of the PI and co-PIs and the strength of the applicant group, including likely synergy in delivering research and potential for international leadership.*

6.3. Selection of Peer Reviewers/Evaluators is at the sole and exclusive discretion of the Singapore Food Story R&D Programme Office, which shall not be liable for the release of information concerning proposals to third parties by individuals involved in the review process. The Singapore Food Story R&D Programme Office reserves the right to modify the review process.

6.4. Applicants shall agree that they shall not take legal action against the SFA, the Peer Reviewer, or any member of the Project Evaluation Panel in relation to their role in evaluating and deliberating the project proposal.

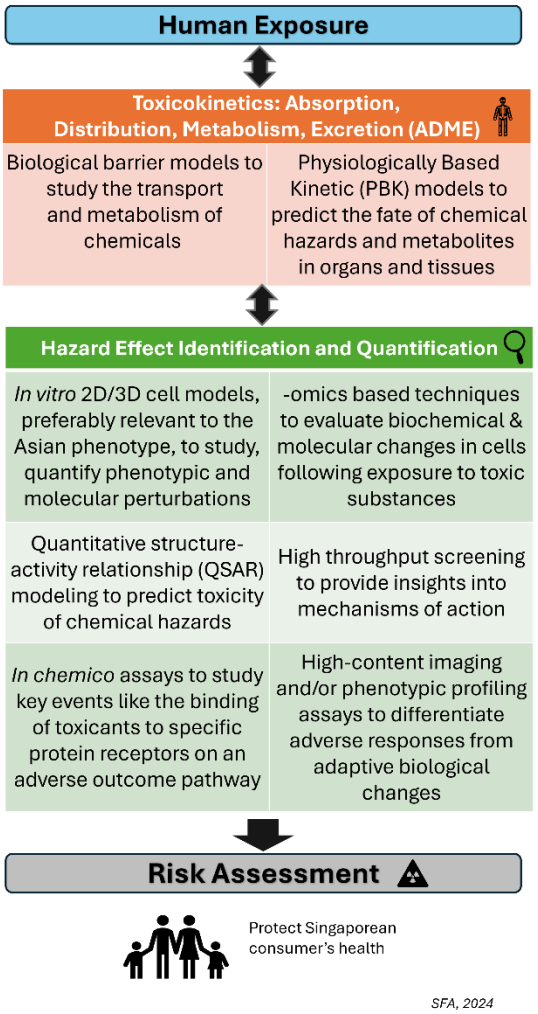
6.5. The SFA is under no obligation to award research grant in whole or in part to any proposal. SFA may require proposals to be revised or combined as it sees fit to enhance research outcomes, facilitate integration of research concepts and technologies, and optimise funding resources. **SFA's decision on project and funding support will be final** and shall be abided by the applicants.

7. CONTACT

7.1. For further enquiries, please contact the Singapore Food Story R&D Programme Office at SFA_RND@sfa.gov.sg.

ANNEX

Annex 1 - Integration of NAM-based tools and platforms into a simplified NGRA framework for the risk assessment of chemical food hazards.



Annex 2 – Average cost for the use of animal models for various toxicity testing.

Test	**U.S. Environmental Protection Agency estimated average test cost (2023) (USD)**
90-day oral toxicity in rodents	$209,100
90-day Neurotoxicity (rat)	$303,900
Acute neurotoxicity (rat)	$205,900
Metabolism and pharmacokinetics	$258,800
90-day inhalation toxicity (rat)	$693,900
Combined Chronic Toxicity/Carcinogenicity Testing of Respirable Fibrous Particles (inhalation route)	$4,904,900
Prenatal developmental toxicity study (rat)	$154,900
Prenatal developmental toxicity study (rabbit)	$220,500
Reproduction and fertility effects (multigeneration) - rat	$520,500

Annex 3 – Examples of commercial research organisations (CROs) and public sector R&D organisation that perform toxicity testing.

1. Eurofins
2. Vectura Fertin
3. Lab Corp
4. SGS Singapore
5. Research Support Centre, A*STAR

Annex 4 – List of chemical hazard classes of interest found in cell-based food and fermentation-derived food products (non-exhaustive).

	S/N	**Classes of Chemical Hazards**
Cell-based food	1	Small molecules for the proliferation and differentiation of cells
	2	Growth factors, cytokines, hormones with no equivalent presence in meat
	3	Shear force protectants
Precision fermentation-derived	1	Allergenic potential of proteins made with precision fermentation due to differential post-translational modifications from conventionally sourced proteins
	2	Proteins introduced into the production organism (e.g. from selection genes)

Biomass fermentation-derived	1	Emerging mycotoxins
	2	Biogenic amines
	3	Unintended metabolites from fermented food

APPENDIX 1 – NON-FUNDABLE DIRECT COSTS OF RESEARCH

Information on non-fundable direct costs of research is appended in the tables below.

Type of Expenses	Description
Salaries of Lead PIs / Investigators	Not allowable, to ensure no double-funding of salaries and related costs, as the salaries are already supported from other sources (e.g. faculty salaries are supported separately by the IHL as it is in support of the IHLs' core mission).
Salaries of teaching staff / Teaching substitutes	Not allowable, as this is already being supported from capitation grants.
Undergraduate tuition support	Not allowable, as this should be supported under the respective scholarship grants and bursary schemes.
Salaries of general administrative support staff	Not allowable, as this is an indirect cost*
Costs related to general administration and management	Not allowable, as this is an indirect cost*. This includes common office equipment, such as furniture and fittings, office software, photocopiers, scanners and office supplies.
Costs of office or laboratory space	Not allowable, as this is an indirect cost*. This includes renovation/outfitting costs, rent, depreciation of buildings and equipment, and related expenditures such as water, electricity, general waste disposal and building/facilities maintenance charges.
Personal productivity tools & communication expenses	Not allowable, unless the use of mobile phones and other form of smart devices were indicated in the methodology for the Research/I&E Project. All other costs under this expense type should be supported from Indirect Costs.
Entertainment	Not allowable, as this is an indirect cost*.
Refreshment	Not allowable, unless this is related to a hosted conference or workshop for the Research/I&E Project. All other costs under this expense type should be supported from Indirect Costs.
Audit fees (Internal and external audit) and Legal fees	Not allowable, as this is an indirect cost*.
Fines and Penalties	
Professional Membership Fees	
Staff retreat and team-building activities	
Patent Application	Not allowable, as this should be supported from overheads given to I&E Office (IEO). This includes patent application filing, maintenance and other related costs.

*Indirect Costs should be funded from the provided Indirect Costs or from other funding sources.