Project Title:	**Circular economy in the context of food supply chains**	
Project Number	IMURA1073	
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Research Clusters:

Research Themes:

Highlight which of the Academy's CLUSTERS this project will address? *(Please nominate JUST __one.__ For more information, see www.iitbmonash.org)*	**Highlight which of the Academy's Theme(s) this project will address?** *(Feel free to nominate more than one. For more information, see www.iitbmonash.org)*
1 Material Science/Engineering (including Nano, Metallurgy)	*1* Artificial Intelligence and Advanced Computational Modelling
2 Energy, Green Chem, Chemistry, Catalysis, Reaction Eng	2 Circular Economy
3 Math, CFD, Modelling, Manufacturing	3 Clean Energy
4 CSE, IT, Optimisation, Data, Sensors, Systems, Signal Processing, Control	4 Health Sciences
5 Earth Sciences and Civil Engineering (Geo, Water, Climate)	5 Smart Materials
6 Bio, Stem Cells, Bio Chem, Pharma, Food	6 Sustainable Societies
7 Semi-Conductors, Optics, Photonics, Networks, Telecomm, Power Eng	
8 HSS, Design, Management	

The research problem

With increasing population, product demands, economic and environmental liability, the implementation of circular economy (CE) in supply chain (SC) management has become one of the most important areas of research both by industry practitioners and academics. Especially, CE in the food supply chain, if implemented successfully, can maintain green production planning/processing, and promote environmentally friendly logistics and distribution to reduce spoilage and degradation in quality while maintaining significant margins. The unique characteristics of limited shelf life and perishability make the food SC even more complex, which requires effective SC management to manage food safety, reduce losses, and maximize product shelf-life.

In this digital era, consumers have the option of buying food from multiple locations like mart, retail groceries, and e-commerce platforms. This led to higher demand for different types of food (fresh versus packaged) in higher volume ([Costa et al. 2014](#); [Suryawanshi et al. 2021](#)). However, this over-consumption led to higher food waste: globally, around one third of the food produced is wasted costing economic disadvantages for the organisations and country. Food loss and waste can happen throughout the food supply chain. When the loss occurs in the upstream food supply chain it is termed food loss while the food waste occurs when edible food is discarded at the retail or consumers end. According to UN, 14% of the food produced is lost between harvest and retail while 17% of the global food produced is wasted in the downstream stages. According to the UN Environmental Programme in 2021, 931 million tonnes of food is wasted globally. In India, the amount of food wasted is 50 kg/capita/year. To handle the global food waste issue, the UN Sustainable Development Goal 12.3 seeks to ensure sustainable consumption and production patterns across the food supply chain.

In the perspective of sustainable food SC, the shifts from linear to circular SC helps to reduce the food loss and food waste through reuse, recycling, remanufacturing, or refurbishing, resulting in zero or little waste generation. The transition to CE needs to be cost-effective while also helping to preserve the environment and address societal concerns.

However, studies anecdotally found several challenges in implementing the CE practices in food supply chain. Some of these are lack of a) inefficient regulatory policies, b) sustainable green technologies, c) data storage and processing, d) traceability of the different processes during the supply chain stages, e) standard methods to reduce, reuse or recycle, and reverse logistics and f) social acceptance of remanufactured food.

Although, various challenges make the shift to CE less competitive among the peers, with the help of advanced technologies and faster digitization, the transition from linear to circular supply chain could provide competitive edge to the industry. Therefore, there is an urgent need for in-depth research in identifying barriers and drivers for effective adoption of CE practices in food supply chain to reduce the gap between the literature and supply chain practitioners.

Project aims

The aim of the research is to study and identify the key challenges and opportunities in adopting circular economy practices in the management of food supply chain, food waste and its sustainability. Further, this research aims to identify the key barriers and drivers in implementing CE practices in sustainable food supply chain through various qualitative and quantitative techniques.

With technological advancements, global sourcing, and strategic collaboration among supply chain stakeholders, studies on sustainable supply chain practices have increased in recent years. Also, with increasing amount of data and the global application of industry 4.0 and data analytics, transformation of supply chain from linear to circular can be effective and provide competitive advantages to the organizations. The findings from this research can provide much needed guidance to the key food organisations in their journey from linear to CE model, balancing economic, social and environmental opportunities and achieving SDG 12.

What is expected of the student when at IITB and when at Monash?

Highlight how the project will gain from the students stay at IITB and at Monash

Understanding the topic of research project, its background study, literature survey, research gap, and research questions identification will be done at IITB. The methodological development and its implementation will be done at Monash. Both the data collection, analysis, and manuscript preparation will be done at both places as and when required.
The students are encouraged to present their research findings at the Monash to a group of experts in CE.

Expected outcomes

Highlight the expected outcomes of the project

The expected outcomes of the project are as follows:
 • An extensive literature survey for an in-depth study of sustainable supply chains and circular economy practices in the perspective of food supply chain.
• To identify key success factor of the adoption of circular economy practices in food supply chains
• To identify prospective research problems pertaining to the study of sustainable food supply chain and circular economy.
• To design qualitative and quantitative research framework/models that would promote the circular economy practices in food supply chains.
 • The proposed models will be illustrated and validated using empirical or case studies where appropriate.

How will the project address the Goals of the above Themes?

Describe how the project will address the goals of one or more of the 6 Themes listed above.

The scope of the research lies very much within the management of food supply chain, food waste, sustainability and circular economy. Various qualitative and quantitative techniques, survey methods, emerging technologies, machine learning and data analytics will be used in order to achieve the objectives of the study.

Potential RPCs from IITB and Monash

Prof. Rajendra M Sonar, SJM School of Management, IIT Bombay

Prof. Daniel Prajogo, Monash University

Capabilities and Degrees Required

M. Tech. in Industrial Engineering or MBA or Master degree in related disciplines.

It is highly desirable to have candidates

- with a strong knowledge in industrial engineering/operations research/data science;

- who have undertaken courses in statistics/business analytics;

- who are aware of operations management/supply chain/business research methods;

- who have experience in coding in any programming languages/machine learning/AI.

Necessary Courses

Name three tentative courses relevant to the project that the student should complete during his/her coursework at IITB (the student will require to secure 8 point in these courses)

Research Methodology

Statistical Methods

Survey Research Methods

Qualitative Research Methods

Decision Models in Management

Potential Collaborators

Please visit the IITB website www.iitb.ac.in OR Monash Website www.monash.edu to highlight some potential collaborators that would be best suited for the area of research you are intending to float.

Select up to **(4)** keywords from the Academy's approved keyword list **(available at http://www.iitbmonash.org/becoming-a-research-supervisor/)** relating to this project to make it easier for the students to apply.

Management; Data Science; Sustainability; Optimisation, Modelling and Simulation; Smart Manufacturing