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**DEVELOPING POLICIES FOR TRANSFORMING
SMALLHOLDER AGRI-FOOD SUPPLY CHAINS IN
DEVELOPING ECONOMIES: A DIGITAL PATHWAY
TO SUSTAINABLE VALUE CREATION**

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Doctor of Philosophy

Department of Transport Management & Logistics Engineering

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DECLARATION

As per the cotutelle agreement between the University of Moratuwa, Sri Lanka, and the University of Stavanger, Norway, this thesis has been prepared and submitted under a joint supervision arrangement. This cotutelle agreement was approved under Council Memo No: 509.05.07 at the 509th Council Meeting held on 3rd May 2023.

I declare that this thesis is my own work and that it does not incorporate, without acknowledgement, any material previously submitted for a degree or diploma at any other university or institute of higher learning. To the best of my knowledge and belief, it does not contain any material previously published or written by another person except where due acknowledgement is made in the text.

I retain the right to use this content, in whole or in part, in future publications such as journal articles or books.

Signature:

Date: 19/11/2025

The above candidate has carried out research for the PhD thesis under my supervision. I confirm that the declaration made above by the student is true and correct.

Name of Supervisor: A.I.T. Gamage

Signature of the Supervisor:

Date: 19/11/2025

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ABSTRACT

Smallholder agriculture is critical for food security, engaging nearly two billion farmers in developing economies and contributing to the reduction of rural poverty. However, productivity is frequently hindered by inefficiencies in agri-food supply chains, suboptimal agricultural practices, climatic challenges, and a lack of market access. This PhD study investigates the capacity of digital transformation and policies to facilitate sustainable value generation in smallholder farmer supply chains. It addresses critical research gaps, including the lack of investigation into smallholder agricultural systems from a supply chain perspective, the absence of customized digital solutions and novel business models, and the insufficient evaluation of the impact of these solutions on farmers' livelihoods. Guided by a pragmatic research philosophy, the study employs a three-phase mixed-methods approach encompassing diagnostic analysis, solution development, and policy integration. This project centers on the Sri Lankan tea smallholding sector as its primary case study. The research identifies structural bottlenecks and digital literacy gaps that hinder sustainability, prioritizes digital interventions such as digitized farm records and digital registration and evaluates the role of voluntary sustainability standards in improving market access. It further develops a fuzzy logic-based risk assessment framework to assess policy effectiveness. The study proposes a digitally enabled business model incorporating digital product passports to enhance traceability, compliance, and value creation. The findings demonstrate that integrating digital solutions with targeted policy frameworks can enhance the resilience, inclusivity, and market competitiveness of smallholders. This approach offers both theoretical contributions to sustainable supply chain management and actionable recommendations for policymakers, industry stakeholders, and development practitioners.

Keywords: smallholders, agri-food supply chains, developing economies, digital transformation, sustainable value creation, policy, supply chain

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LIST OF ABBREVIATIONS

Abbreviation	Description
AFSCs	Agri-Food Supply Chains
SCQM	Supply Chain Quality Management
SCM	Supply Chain Management
BoP	Base of the Pyramid
SSCM	Sustainable Supply Chain Management
RQs	Research Questions
ROs	Research Objectives
CLD	Causal Loop Diagramming
AHP	Analytic Hierarchy Process
TOPSIS	Technique for Order Preference by Similarity to Ideal Solution
FIS	Fuzzy Inference Systems
VSSs	Voluntary Sustainability Standards
MPI	Market Potential Index
PPWR	Packaging Waste Regulation
DPP	Digital Product Passports

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