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IAIC

2021

Proceedings of International Agriculture Innovation Conference

September 3th -4th Webinar, Tokyo, Japan

Organizer

IAAS

Waseda Business School
(Graduate School of Business and Finance)

Joint-Organizer

Sponsor

International Association for Agricultural Sustainability

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3rd September, 2021		
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08:45	07:45	**Registration**
09:00	08:00	**Opening Ceremony** **Welcome Remarks** **Dr. Cheng-I Wei** Chairman, International Association for Agricultural Sustainability (IAAS), Singapore Professor & Interim Chair, Department of Nutrition and Food Science, College of Agriculture and Natural Resources, University of Maryland, USA **Dr. Hironori Higashide** Local Chairman, 2021 International Agriculture Innovation Conference (IAIC 2021) Professor, Waseda Business School (Graduate School of Business and Finance), Waseda University, Japan **Ms. Sharon Ho** Representative, Malaysian Friendship & Trade Centre, Malaysia
09:20	08:20	**Keynote Speech** **Dr. Ruben G. Echeverría** Chair, Commission on Sustainable Agriculture Intensification (CoSAI), USA *Topic: Innovation Investments in Sustainable Agriculture Intensification for the Global South*
09:40	08:40	**Special Report** **Mr. Sumito Yasuoka** Councillor at Agricultural Production Bureau, Ministry of Agriculture, Forestry and Fisheries, Japan *Topic: Innovations and Challenges for Agriculture in Japan*
10:00	09:00	**Fermentation Science and Branding for Wineries** **Dr. Nathalie Ollat** Director, Ecophysiology and Functional Genomics of Grapevine Laboratory, Biology and Plant Breeding, National Research Institute for Agriculture, Food and Environment (INRAE), France *Topic: Research to Support the Wine Sector Towards Higher Sustainability in France* **Dr. Jicheng Zhan** Professor, Food Science and Nutritional Engineering College, China Agricultural University, China *Topic: Wine of China* **Dr. Pekka Kess** Adjunct Professor, Industrial Engineering and Management, University of Vaasa, Finland *Topic: Beer Logistics Between Finland and Estonia*

		Dr. Chienhao Chen Associate Professor, Department of Food & Beverage Management, National Kaohsiung University of Hospitality and Tourism, Taiwan *Topic: The Taiwan Wine and Spirit Renaissance* **Dr. Chang-Wei Hsieh** Distinguished Professor, Department of Food Science and Biotechnology, National Chung Hsing University, Taiwan *Topic: Novelty Processing for Escalating the Quality of Chinese Spirits*
11:20	10:20	**Panel Discussion: Fermentation Science and Branding for Wineries** **Moderator: Dr. Cheng-I Wei** Professor & Interim Chair, Department of Nutrition and Food Science, College of Agriculture and Natural Resources, University of Maryland, USA **Panelist:** **Mr. Toshihiko Takatani** Representative Director, Jisedai Ichijisangyo Jissenjo (Next Generation Primary Industry Practice) Corp. **Dr. Yves Waché** Professor of Microbiology and Biotechnology, AgroSup Dijon, France **Dr. Jicheng Zhan** Professor, Food Science and Nutritional Engineering College, China Agricultural University, China **Dr. Pekka Kess** Adjunct Professor, Industrial Engineering and Management, University of Vaasa, Finland **Dr. Chienhao Chen** Associate Professor, Department of Food & Beverage Management, National Kaohsiung University of Hospitality and Tourism, Taiwan
12:00	11:00	**Protein Revolution** **Dr. Dejian Huang** Deputy Head of Department and Associate Professor, Department of Food Science & Technology, National University of Singapore (NUS), Singapore *Topic: Agricultural and Food Processing Byproducts: The Common Roots for Alternative Proteins and Cell-based Meats* **Dr. Miranda Mirosa** Associate Professor, Department of Food Science, University of Otago, New Zealand *Topic: Consumer Insights into the 'Alternative' Protein Revolution* **Dr. Lu-Sheng Hsieh** Assistant Professor, Department of Food Sciences, Tunghai University, Taiwan *Topic: Production of Cinnamate Derivatives by Immobilization of Bambusa Oldhamii Phenylalanine Ammonia-lyase on Electrospun Nanofibers* **Dr. Shijie Ding** Associated Professor, Nanjing Agricultural University (NAU), China *Topic: Cultured Meat in China*
13:00	12:00	**Panel Discussion: Protein Revolution** **Moderator: Dr. Cheng-I Wei**

		Professor & Interim Chair, Department of Nutrition and Food Science, College of Agriculture and Natural Resources, University of Maryland, USA **Panelist:** **Mr. Seiya Ashikari** CEO, Ecologgie Inc., Japan **Dr. Chih-Cheng Lin** Vice Chairman, 2021 International Agriculture Innovation Conference President and Professor, Yuanpei University of Medical Technology, Taiwan **Dr. Dejian Huang** Deputy Head of Department and Associate Professor, Department of Food Science & Technology, National University of Singapore (NUS), Singapore **Dr. Lu-Sheng Hsieh** Assistant Professor, Department of Food Sciences, Tunghai University, Taiwan
13:30	12:30	**Lunch Time**
14:00	13:00	**Panel Discussion: Family Enterprise in Agriculture** **Moderator: Dr. Annie Koh** Professor Emeritus, Lee Kong Chian School of Business, Singapore Management University (SMU), Singapore **Panelist:** **Mr. Ankesh Shahra** Founder and CEO, Agrimax Ventures, Singapore **Mr. Ho Ren Hua** CEO, Thai Wah Public Company, Singapore **Ms. Hidemi Masuda** Senior Managing Director, Masuda Seed Co. Ltd., Japan **Mr. Takuro Nagahara** President and Representative Director, Kimise Brewery Co. Ltd., Japan **Dr. Hironori Higashide** Professor, Waseda Business School (Graduate School of Business and Finance), Waseda University, Japan
15:00	14:00	**Agri-Product International Branding (Local Revitalization/ International Branding)** **Ms. Marja Salonen** Excecutive Manager, Leader Viisari, Finland *Topic: Local Revitalization Study in Rural Finland* **Dr. Eva Ting-Yueh Kang** Director, Regional Revitalization Project Office, Taiwan Institute of Economic Research, Taiwan *Topic: Policy and Practices of Local Revitalization of Taiwan* **Dr. Mark C. Zeller** Committee Member, Department of Communication, Intelligent Community Forum Research Committee, USA. *Topic: Transformative and Sustainable Agricultural Practices within the Bounded Rationality of Community Development: Longitudinal Information Communication Technologies (ICTs) Research with Water Quality Issues Emerging in Northwest Ohio, United States*

		Dr. Teruyoshi Yanagita Director and Guest Professor, Saga Food & Cosmetic Laboratory, Saga Prefecture Industrial Innovation Center & Saga University, Japan *Topic: Local Revitalization and Agricultural & Food Innovation in Saga, Japan*
16:00	15:00	**Panel Discussion: Agri-Product International Branding** **Moderator: Dr. Pensri Jaroenwanit** Dean and Associate Professor, Faculty of Business Administration and Accountancy, Khon Kaen Business School, Khon Kaen University, Thailand **Panelist:** **Mr. Sumito Yasuoka** Councillor, Forestry and Fisheries, Ministry of Agriculture, Japan **Ms. Marja Salonen** Excecutive Manager, Leader Viisari, Finland **Dr. Eva Ting-Yueh Kang** Director, Regional Revitalization Project Office, Taiwan Institute of Economic Research, Taiwan **Dr. Mark C. Zeller** Committee Member, Department of Communication, Intelligent Community Forum Research Committee, USA **Dr. Teruyoshi Yanagita** Director and Guest professor, Saga Food & Cosmetic Laboratory, Saga Prefecture Industrial Innovation Center & Saga University, Japan
16:40	15:40	**Trending Issue I** **Mr. Stephen Ho** Independent Director, AZEUS Systems, Singapore *Topic: Family Farms and Enterprises in the Agriculture Sector in Taiwan: Challenges and Strategies* **Dr. Wee Liang Tan** Associate Professor, Singapore Management University, Singapore *Topic: Weathering the Storms Impacting Agribusiness: Examining Some Suggestions* **Dr. Saikou E. Sanyang** Director General, Department of Agriculture, Ministry of Agriculture, Gambia *Topic: Family Enterprise in Agriculture The Gambia* **Dr. Chia-Lin Chang** Vice President, International Affairs, National Chung Hsing University, Taiwan *Topic: The Global Impact on the World Economies and Agricultural Trade During Pre- and Post- COVID-19 Pandemic* **Dr. Kothandapani Ganesh** Senior Knowledge Expert & Global Lead, MSC-X, McKiney Knowledge Center (McKC), McKinsey & Company, India *Topic: Prespetive on Digital & Analytics in Agriculture*
17:55	16:55	**Panel Discussion: Trending Issue** **Moderator: Dr. Kuei-Son Sheu** Convener of African Swine Fever Working and Counselor, Council of Agriculture, Taiwan

		Panelist: **Dr. Ho-Hsien Chen** Dean and Professor, College of Agriculture, National Pingtung University of Science And Technology, Taiwan **Dr. Bayanjargal Darkhijav** Professor, Department of Applied Mathematics, School of Applied Science and Engineering, National University of Mongolia, Mongolia **Dr. Jung-Kun Park** Professor, School of Business, Hanyang University, Seoul, Korea **Mr. Stephen Ho** Independent Director, AZEUS Systems, Singapore **Dr. Saikou E. Sanyang** Director General, Department of Agriculture, Ministry of Agriculture, Gambia **Dr. Kothandapani Ganesh** Senior Knowledge Expert & Global Lead, MSC-X, McKiney Knowledge Center (McKC), McKinsey & Company, India
18:25	17:25	**Close Remarks** **Dr. Tzong-Ru Lee** Chairman, International Agriculture Innovation Conference (IAIC) Vice Chairman, International Association for Agricultural Sustainability (IAAS), Singapore Professor, Marketing Department, National Chung Hsing University, Taiwan

4th September, 2021		
JST	**SGT**	**Agenda**
08:45	07:45	**Registration**
09:00	08:00	**Welcome Remarks** **Dr. Wee Liang Tan** Secretary General, International Association for Agricultural Sustainability (IAAS), Singapore Associate Professor, Singapore Management University, Singapore
09:02	08:02	**Knowledge-Based Agriculture** **Dr. Ville Isoherranen** Director and Adjunct Professor, School of Engineering and Natural Resources, Oulu University of Applied Sciences (OUAS), Oulu, Finland *Topic: OUAS Research, Development and Innovation (RDI) Projects in Agriculture: Towards Low Carbon Society* **Ms. Shya-Li (Alice) Chou** Vice President, Taiwan Institute of Economic Research, Taiwan *Topic: Multidisciplinary Recycling: A Practical Strategy for the Development of Circular Agriculture in Taiwan* **Dr. Wei Fang** Professor, Department of Biomechatronics Engineering, National Taiwan University, Taiwan *Topic: Agroecology - Circular Food and Agriculture Systems*

		Mr. Horng-Yuh Guo Retired Soil Scientist & Director, Taiwan Agricultural Research Institute, Taiwan *Topic: Progressing of Smart Agriculture in Taiwan* **Dr. Ravi Khetarpal** Executive Secretary, Asia-Pacific Association of Agricultural Research Institutions (APAARI), Thailand *Topic: Strengthened Research and Innovations for Sustainable Agricultural Development in Asia and the Pacific* **Dr. Nen-Fu (Fred) Huang** Dean and Professor, College of Electrical Engineering and Computer Science, National Tsing Hua University, Taiwan *Topic: Smart Paddy Irrigation Systems*
10:30	09:30	**Panel Discussion: Knowledge-Based Agriculture** **Moderator: Dr. Huu-Sheng Lur** Dean and Professor, College of Bioresources & Agriculture, National Taiwan University, Taiwan **Panelist:** **Mr. Kohei Koide** President and CEO, Watami Organicland Co. Ltd., Japan **Dr. Petr Skobelev** Professor and Head, Electronic Systems Department, Samara Technical University, Russia **Dr. Ravi Khetarpal** Executive Secretary, Asia-Pacific Association of Agricultural Research Institutions (APAARI), Thailand **Dr. Ville Isoherranen** Director and Adjunct Professor, School of Engineering and Natural Resources, Oulu University of Applied Sciences (OUAS), Finland **Ms. Shya-Li (Alice) Chou** Vice President, Taiwan Institute of Economic Research, Taiwan **Dr. Wei Fang** Professor, Department of Biomechatronics Engineering, National Taiwan University, Taiwan
11:00	10:00	**Halal Products** **Dr. Mohd Nasir Mohd Desa** Director, Halal Products Research Institute, Universiti Putra Malaysia, Malaysia *Topic: Halal Management and Certification; the Malaysian Scenario* **Mr. Fahad S. Damanhouri** Manager, Business Development, Makkah Chamber of Commerce and Industry, Saudi Arabia *Topic: Introduction and Trend of Halal Process in the Kingdom of Saudi Arabia*
11:30	10:30	**Panel Discussion: Halal Products** **Moderator: Dr. Tzong-Ru Lee** Professor, Marketing Department, National Chung Hsing University, Taiwan

		Panelist: **Ms. Asako Shimazaki** Executive Officer cum Head, Food Department, Ryohin Keikaku Co. Ltd., Japan **Dr. Rika Ampuh Hadiguna** Professor, Industrial Engineering, Faculty of Engineering, Andalas University, Indonesia **Dr. Amirul Afif Muhamat** Deputy Dean (Research & Innovation), Faculty of Business and Management, Universiti Teknologi, MARA, Malay, Malaysia **Dr. Mohd Nasir Mohd Desa** Director, Halal Products Research Institute, Universiti Putra Malaysia, Malaysia **Dr. Mamun Habib** Professor, Independent University, Bangladesh; University of Texas - Arlington (UTA), USA
11:50	10:50	**Trending Issue II** **Ms. Joanna Kane-Potaka** Assistant Director General - External Relations, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), India *Topic: Leveraging the UN International Year of Millets 2023* **Dr. Mari Maeda-Yamamoto** Senior Principal Scientist, National Agriculture and Food Research Organization (NARO), Japan *Topic: The Current Status of Self-care Initiatives Using Functional Agricultural Products in Japan* **Dr. Tian-Zhu Zhang** Professor, College of Water Resources & Civil Engineering, China Agricultural University, China *Topic: Applications and Challenges of ESG in China's Agriculture* **Dr. Vijay P. Singh** Distinguished Professor, Department of Biological and Agricultural Engineering & Zachry Department of Civil Engineering, Texas A&M University, USA *Topic: Irrigated Agriculture for Food Security*
13:00	12:00	**Panel Discussion: Trending Issue** **Moderator: Dr. Tzong-Ru Lee** Professor, Marketing Department, National Chung Hsing University, Taiwan **Panelist:** **Mr. David Shearer** Deputy Head of Secretariat , Commission on Sustainable Agriculture Intensification (CoSAI), Australia **Dr. Prasad Dharmasena** Director and CEO, National Institute of Plantation Management, Ministry of Plantation, Sri Lanka **Ms. Joanna Kane-Potaka**

		Assistant Director General - External Relations, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), India **Dr. Mari Maeda-Yamamoto** Senior Principal Scientist, National Agriculture and Food Research Organization (NARO), Japan
13:20	12:20	**Industry Dynamics** **Mr. Min-Hung (Richard) Chen** President, Greenday Biotech Inc., Taiwan *Topic: High Speed Chicken Waste Disposal Machine* **Mr. Poyu (Brian) Chen** Executive Director, Rolling Greens Co. Ltd., Taiwan *Topic: Lil Heroes in the Soil* **Mr. Mark Lan** Conference Specialist, Jia Wen Cing Light Ooling Tea Shop, Taiwan *Topic: Combination of Taiwan Agricultural Products and Hand-shaken Drinks* **Dr. Chien-Liang Kuo** C.M.D., Nutritionist, Food technician, Taiwan *Topic: Sustainable Production of Natural Anti-inflammatory Substances: Take Antrodia cinnamomea as An Example* **Mr. Johnny Tu** CEO, Hwa Gung Tea Co. Ltd., Taiwan *Topic: The Inheritance and Innovation of Taiwan's Local Tea Industry for a hundred Years*
14:20	13:20	**Panel Discussion: Industry Dynamics** **Moderator: Dr. Tzong-Ru Lee** Professor, Marketing Department, National Chung Hsing University, Taiwan **Panelist:** **Dr. Patrick C. K. Hung** Professor, Ontario Tech University, Canada **Dr. Desislava Serafimova** Professor, The University of Economics- Varna, Bulgaria **Mr. Min-Hung (Richard) Chen** President, Greenday Biotech Inc., Taiwan **Mr. Poyu (Brain) Chen** Executive Director, Rolling Greens Co. Ltd, Taiwan **Mr. Jia-Yuan Lin / Ms. Teresa Lin / Mr. Mark Lan** CEO/CFO/Conference Specialist, Jia Wen Cing Light Ooling Tea Shop, Taiwan **Mr. Johnny Tu** CEO, Hwa Gung Tea Co. Ltd., Taiwan
14:40	13:40	**Close Remarks** **Dr. Tzong-Ru Lee** Chairman, International Agriculture Innovation Conference (IAIC) Vice Chairman, International Association for Agricultural Sustainability (IAAS), Singapore

		Professor, Marketing Department, National Chung Hsing University, Taiwan
14:45	13:45	**Break Tea**
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19:45	18:45	**Close Remarks** **Dr. Tzong-Ru Lee** Chairman, International Agriculture Innovation Conference (IAIC) Vice Chairman, International Association for Agricultural Sustainability (IAAS), Singapore Professor, Marketing Department, National Chung Hsing University, Taiwan
Paper Presentation Room B		
15:00	14:00	**Paper Presentation Session B-1** **Session Chair: Dr. Yves Waché** Professor, Microbiology and Biotechnology, AgroSup Dijon, France *IAIC2021-P022* *IAIC2021-P023*

		IAIC2021-P026 *IAIC2021-P035* *IAIC2021-P039* Q&A
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18:00	17:00	**Paper Presentation Session B-3** **Session Chair: Dr. Pekka Kess** Adjunct Professor, Industrial Engineering and Management, University of Vaasa, Finland *IAIC2021-P025* *IAIC2021-P038* *IAIC2021-P040* *IAIC2021-P047* *IAIC2021-P050* Q&A
19:00	18:00	**Close Remarks** **Dr. Tzong-Ru Lee** Chairman, International Agriculture Innovation Conference (IAIC) Vice Chairman, International Association for Agricultural Sustainability (IAAS), Singapore Professor, Marketing Department, National Chung Hsing University, Taiwan

Conference Member

Organizer

The International Association for Agricultural Sustainability (IAAS)

IAAS serves as an international platform for academicians, researchers, industry players and policymakers in the fields of agro-technology, sustainability, food technology, innovation, management and economics to communicate and interact for the advancement of research, instruction, trade promotion, and policy development.

http://iaas.org.sg/

Local Organizer

Waseda University Business School (WBS)

Waseda Business School (WBS) aims to support those who aspire to a step-up in their career and those who plan to start a new career by studying at a business school. Our society today is undergoing rapid change. The world is globalizing, new technologies are appearing successively, and the market is changing. In order to survive in the global competitive environment, management knowledge of a global standard is essential. We need to acquire the capacity to solve problems - to identify the essence of the problem, to find a solution to it, and to implement the solution - and develop practical skills to tackle the problems for which our experience so far is not applicable. WBS is the best place to acquire management knowledge, problem-solving capability, the capacity to act, and leadership skills.

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Conference Honorary Chair

Dr. Cheng-I Wei

Professor & Acting Chair, Department of Nutrition and Food Science, College of Agriculture and Natural Resources, University of Maryland, USA
Chairman, International Association for Agricultural Sustainability, Singapore

Conference Chair

Dr. Tzong-Ru Lee

Professor, Marketing Department, National Chung Hsing University (NCHU)
CEO of IAC of NCHU-APAARI Center of Excellence on Value Chain, NCHU.
Vice Chairman, International Association for Agricultural Sustainability (IAAS)
Editor-in-Chief, International Journal of Agriculture Innovation, Technology and Globalisation (IJAITG)
Associate Editor: JILEG, IJGC
Editorial board member: IJSCM, IJECRM, JSCR, WRITR, ISCT

Local Conference Chair

Dr. Hironori Higashide

Professor, Graduate School of Business and Finance, Waseda University Business School, Japan
Director, WASEDA Entrepreneurship Research Unit (WERU).
Director, WERU Investment Ltd., Waseda university-related venture capital fund, as well as Entrepreneurs' alumni association of Waseda University
MBA and Ph.D. in Entrepreneurship, Imperial College, University of London.

Vice Conference Chair

Dr. Chih-Cheng Lin

President, Yuanpei University of Medical Technology, Taiwan
Professor, Department of Biotechnology and Pharmaceutical, Department of Food Science, Yuanpei University of Medical Technology, Taiwan
President, Health Management Society of Taiwan
Honorary President, Association of Taiwan Tea, Taiwan
Advisory Committee Member, FDA, Ministry of Health and Welfare, Taiwan

Chairperson, 1st Asia-pacific Tea Expo (2017)
Host, Taiwan Eight Central-Northern Cities and Counties Vice President Forum (2014)
Technology Achievement Award, Agricultural Chemistry of Taiwan (2016)

Conference Executive Director

Mr. Kuo-Chang Fu

PhD (GM) Candidate of LKCSB Singapore Management University, Singapore
Founder, Vital Wellspring Group, Singapore
Founder, International Association for Agricultural Sustainability, Singapore
Chairman & CEO, AgriGADA Biotech Ltd., Singapore

Local Conference Executive Director

Dr. Katsushi Yamaguchi

Professor of Department of Management at Japan University of Economics, Japan
Global STEP (Successful Transgenerational Entrepreneurship Practices), Japan
WBS Research Center, Waseda University Graduate School of Commerce, Japan

Keynote Speech

Dr. Ruben G. Echeverría
Chair, Commission on Sustainable Agriculture Intensification (COSAI), USA

Dr. Ruben Echeverría is the Chair of the Commission for Sustainable Agriculture Intensification, a Senior Research Fellow at the International Food Policy Research Institute (IFPRI) based in Washington, DC and Director General Emeritus at the International Center for Tropical Agriculture (CIAT).

Dr. Echeverría was Executive Director of the Science Council of the CGIAR during the mid-2000s. He worked in agricultural, environmental, and rural development issues for more than a decade at the Inter-American Development Bank (IDB) in Washington, DC. Dr. Echeverría studied Agronomy in Uruguay and Agriculture and Applied Economics at the University of Minnesota.

Speech Topic: *Innovation Investments in Sustainable Agriculture Iintensification for the Global South*

Special Report

Mr. Sumito Yasuoka

Councillor at Agricultural Production Bureau, Ministry of Agriculture, Forestry and Fisheries, Japan

Mr. Yasuoka is the Councillor at the Agricultural Production Bureau, which encompasses Production, Marketing, Extension, Innovation and Agri-environmental issues.

He has over thirty years of career as a government official in the field of agricultural policy with a science background. Before taking up the current position, he had led, as a director, the development of smart agriculture, the reform of pesticide/fertilizer regulation and the safety of agricultural products after the Great East Japan Earthquake.

Graduated from University of California, Davis (M.S.) and Kyoto University (B.S.), Professional Engineer (Agriculture)

Speech Topic: *Innovations and Challenges for Agriculture in Japan*

Speech

Dr. Nathalie Ollat

Director, Ecophysiology and Functional Genomics of Grapevine Laboratory, Biology and Plant Breeding, National Research Institute for Agriculture, Food and the Environment (INRAE), France

Nathalie Ollat received a Ph.D. in agronomic sciences from Montpellier Supagro (France), with emphases in viticulture and plant physiology. Dr. Ollat joined the INRA (French National Institute for Agricultural Research) viticulture research center in Bordeaux (France) in 1988, to implement studies on training systems. After dealing with berry development during her Ph-D, she initiated, in the early 2000s, a research program on the interactions of grapevine rootstocks with biotic and abiotic factors. Dr. Ollat and her research team have studied the impact of rootstocks on grapevine nutrition, water intake, vine growth and yields, providing a body of knowledge useful to breed new rootstocks. Since 2010, Dr. Ollat expanded her research efforts to focus on the impact of climate change on grape growing. She currently co-directs the “LACCAVE” program on long-term impacts and adaptations to climate change in viticulture and oenology in France (2012-2020). In April, 2018, she was promoted to the position of director of the Research Unit for Vine Ecophysiology and Functional Genomics (UMR EGFV) within the University of Bordeaux (ISVV: Institute for Sciences of Vine and Wine).

Speech Topic: *Research to Support the Wine Sector Towards Higher Sustainability in France*

Dr. Jicheng Zhan

Professor, Food Science and utritional Engineering College, China Agricultural University, China

Dr. Zhan jicheng is the professor of Food Science and Nutritional Engineering department, China Agricultural University, Where he got his PhD degree. His research expertise and interest is Viticulture and Enology. Now his research is focused on wine flavor Profiled with analytical chemistry techniques and metabolic pathways. He is also interested in the exploitation of indigenous wine yeasts. He has published more than 100 articles in the forms of international peer-reviewed journals. Dr. Zhan is also the chief editor of Wine in China Journal which has established since 2007 and has been one of the most important wine journals of China.

Speech Topic: *Wines of China*

Dr. Pekka Kess

Adjunct Professor, School of Technology and Innovations, Production, University of Vaasa, Finland

Pekka Kess (Dr. Sc, Dr. Eng) is an adjunct professor of industrial engineering and management at the University of Vaasa. He retired in 2020 after 25 years of service from the University of Oulu. He has extensive managerial experience from both universities and industrial enterprises. He has worked in managerial positions in chemical, steel and electronics industries, as well as in the software business. He has been an active project evaluator in the European Commission, as well as a manager of international research and development projects. His research areas cover business ecosystems, strategic management, production organizations, knowledge management with specialization in knowledge transfer, and e-learning.

Speech Topic: *Beer Logistics between Finland and Estonia*

Dr. Chienhao Chen

Associate Professor, Department of Food & Beverage Management, National Kaohsiung University of Hospitality and Tourism, Taiwan

Dr. Chen was the visiting assistant professor of The Hong Kong Polytechnic University. He has been awarded numerous medals in the international wine competitions; since 2013, his fortified wine has won medals award among several international Wine Competitions in 10 wine producing countries and amazed the western world. He is also the Master sommelier and advisor of 12 feasts held by restaurants awarded Michelin 3 stars since 2010.

Speech Topic: *The Taiwan Wine and Spirit Renaissance*

Dr. Chang-Wei Hsieh
Distinguished Professor, Department of Food Science and Biotechnology, National Chung Hsing University, Taiwan

Dr. Chang-Wei Hsieh is a distinguished professor of the Department of Food Sciences and Biotechnology at National Chung Hsing University, Taiwan. Also, a member of the council of the Taiwan Association for Food Science and Technology. His research interests focus on 3 parts now; firstly, application of novel technology in food processing. Secondly, development of long-term preservation technology for agricultural products and food. Lastly, development of functional ingredients of agricultural products.

Speech Topic: *Novelty Processing for Escalating the Quality of Chinese Spirits*

Dr. Dejian Huang

Deputy Head of Department and Associate Professor, Department of Food Science & Technology, National University of Singapore (NUS), Singapore

Dr. Dejian Huang was trained as a chemist from undergraduate to PhD (from Indiana Univiversity. Dejian has established an active research lab in NUS conducting cutting edge research on chemical principles of foods for health promotion and plant proteins for 3D bioprinting of scaffolds and seafood mimics. He is a co-founder of Kosmode Health Singapore Pte Ltd. Dejian has published over 190 scholarly articles and was selected as the most influential scientist by Thomson Reuters in 2014 and 2015. He serves as an associate editor of Journal of Functional Foods.

Speech Topic: *Agricultural and Food Processing Byproducts: The Common Roots for Alternative Proteins and Cell-based Meats*

Dr. Miranda Mirosa
Associate Professor, Department of Food Science, University of Otago, New Zealand

Dr. Mirosa is a Consumer Food Scientist with a background in agri-food marketing and consumer behaviour. She leads a Sustainable Food Systems Behavioural Research Group whose mission is catalysing change for a more sustainable food future. She conducts fundamental and translational behavioural research focused on improving people and planetary health. Miranda's research is providing a credible evidence base for decision-makers in NZ's food industry, the waste sector, the government, and civil society organisations. Miranda's research falls into the following four key food sustainability areas: (1) Reducing food waste; (2) Ensuring food safety and security; (3) Improving food packaging; and (4) Increasing consumption of plant-based foods and novel proteins.

Speech Topic: *Consumer Insights into the 'Alternative' Protein Revolution*

Dr. Lu-Sheng Hsieh

Assistant Professor, Department of Food Sciences, Tunghai University, Taiwan

Dr. Lu-Sheng Hsieh is an assistant professor of Department of Food Sciences, Tunghai University, Taiwan. He received his B.S., M.S., and Ph.D. degrees from National Taiwan University. His postdoctoral training was at the Department of Food Sciences, Institute of Food, Nutrition, and Health, Rutgers, The State University of New Jersey under the guidance of Dr. George M. Carman. Dr. Hsieh's laboratory is focused on the biochemical and molecular characterization of plant secondary metabolism enzymes and yeast phospholipid metabolism enzymes, authoring over 10 refereed publications in these fields.

Speech Topic: *Production of Cinnamate Derivatives by Immobilization of Bambusa Oldhamii Phenylalanine Ammonia-lyase on Electrospun Nanofibers*

Dr. Shijie Ding

Associated Professor, Nanjing Agricultural University, China

Dr. Shijie Ding, the associate professor in Nanjing Agricultural University (NAU), received his PhD degree from the Maastricht University (UM) under the co-supervision of Prof. Mark Post and Prof. Guanghong Zhou. He studied meat science, stem cell biology and tissue engineering in Shanghai Institute of Biochemistry and Cell Biology (SIBCB) and UM. He purified pig and bovine muscle stem cells for cultured meat and is the first PhD in cultured meat field. He is now working in NAU to develop cultured meat technologies. He participated in the development of China's first cultured meat product in 2019. He is also the CTO of Joes Future Food Technology Co. Ltd., the first high-tech company engaged in cultured meat in China. They raised 20 million yuan in financing from Matrix Partners China for the research and industrialization of cultured meat technology.

Speech Topic: *Cultured Meat in China*

Ms. Marja Salonen

Executive Manager, Leader Viisari, Finland

Ms. Marja Salonen has wide experience in rural development due to various positions at JAMK University of Applied Sciences and University of Jyväskylä and other development organizations.

As an expert in public development finance, Ms. Marja Salonen able to help develop local businesses and farmers. Familiarity with foresight methods and innovation processes has strengthened the ability to identify change needs and areas for development and to carry out related processes. Looking at development entities is my strength. The degrees I have completed have provided a good foundation in the activities of people and society and in the business economy.

Speech Topic: *Local Revitalization Study in Rural Finland*

Dr. Eva Ting-Yueh Kang
Director, Regional Revitalization Project Office, Taiwan Institute of Economic Research, Taiwan

Dr. Kang is the research fellow and director of regional revitalization project office at the Research Division VIII, Taiwan Institute of Economic Research. Her research interests focus on Regional Revitalization, Social Innovation, International Trade, Industrial economy, SMEs development, ESG assessments, etc. In recent years, she has invested in research on Regional Revitalization Policies, which is an important national policy in recent years, to face problems such as reduction in total population, aging and low birth rate, excessive concentration of population in large cities and imbalance of urban and rural development. She is the director of Regional Revitalization Project Office and assists National Development Council (NDC) in promoting Regional Revitalization Policy.

Speech Topic: *Policy and Practices of Local Revitalization of Taiwan*

Dr. Mark C. Zeller

Committee Member, Department of Communication, Intelligent Community Forum Research Committee, USA

Mark C. Zeller, Ph.D., teaching at the university level covers research methods, emerging technologies, organizational and commercial development strategic methods at the undergraduate and graduate (Ph.D.) levels. Dr. Zeller's current research is information communication technologies (ICTs) as a community and economic development driver, focusing on rural communities in NW Ohio and NE Indiana. This includes social network analysis of structures and information flow by entrepreneurs, civic and academic leaders. An emphasis has emerged on sustainable agricultural practices and technology addressing evolving and impactful water quality issues in rural communities of the North America Great Lakes region.

Speech Topic: *Transformative and Sustainable Agricultural Practices within the Bounded Rationality of Community Development: Longitudinal Information Communication Technologies (ICTs) Research with Water Quality Issues Emerging in Northwest Ohio, United States*

Dr. Teruyoshi Yanagita
Director and Guest Professor, Saga Food & Cosmetic Laboratory, Saga Prefecture Industrial Innovation Center & Saga University, Japan

Teruyoshi (Terry) Yanagita is a director of Saga Food & Cosmetic Laboratory of Saga Prefecture Industrial Innovation Center and a guest professor and professor emeritus of Saga University, and invited professor of NishiKyushu University. He is a Professor Honarable of National ANCASH University of Peru. He received his Ph.D. from Kyushu University and jointed to the faculty of Saga University (1975-2012) and then jointed to the faculty (Dean) of NishiKyushu University. Terry was a research associate at the University of Virginia School of Medicine (2 years from1980). Terry was invited professor of Yuanpei Univ. of Medical Tech (2012) and Taiwan Agricultural Research Institute (2015). He had served as Vice President of Japan Soc. of Nutrition and Food Science (JSNFS) in 2008-2010. He has received various awards, including Academic Research Award (2006) and Saeki Memorial Award (2014) of JSNFS; and Lands Award of Lipid Nutrition Society (2017); Outstanding Paper Award of AOCS (2004) and Best Paper Award of Int. Lecithin & PL Society (2009) and others. He is an advisor of Japan Science & Technology Agency (JST).

Speech Topic: *Local Revitalization and Agricultural & Food Style Innovation in Saga, Japan*

Mr. Stephen Ho

Independent Director, Azeus Systems, Singapore

Mr. Ho was the former CEO of DBS Asia Capital and the former managing director of DBS Bank (Singapore) Co. Ltd., and DBS Bank (Taiwan) Co. Ltd.

Mr. Ho joined as a managing director DBS' Investment Banking Group in Singapore in June 2001. Prior to joining DBS, he was the Head of Global Telecom, Media & Technology ("TMT") Group in Asia at JP Morgan Chase since 1998. He started his career with Chase in 1989 as a Mergers & Acquisition ("M&A") generalist in New York before specializng in media and telecom sectors in the U.S. and subsequently in Asia.

In addition to his global coverage responsibility as a managing director and Head of the DBS TMT Group from 2001 to mid 2011, he was also Head of DBS Middle East in 2008-9 and Head of DBS Malaysia in 2010-11, before he became the CEO of DBS Asia Capital, a position he held in 2011-13. He was a managing director at DBS Bank (Taiwan) Ltd in 2014-18.

Mr. Ho holds a B.S. in Civil Engineering from Iowa State University, a M.S. from M.I.T. and an MBA from the Wharton School of Finance, University of Pennsylvania.

Speech Topic: *Family Farms and Enterprises in the Agriculture Sector in Taiwan: Challenges and Strategies*

Dr. Wee Liang Tan
Associate Professor, Singapore Management University, Singapore

Dr. Tan has served as a national expert for entrepreneurship and SMEs for APEC, Asian Productivity Organization, the Colombo Plan Secretariat and the Commonwealth Secretariat. His current research interests lie in the domains of entrepreneurship, family business, international cooperation, and corporate governance. His initial research was in law as he began his career as a law professor. He has since moved into entrepreneurship research and published in Journals and Reviews such as the Journal of International Business Studies, Entrepreneurship Theory and Practice and Journal of High Technology Management Research. In addition to journal publications, he serves on the editorial boards of the Journal of Small Business Management, International Entrepreneurship and Management Research, and Small Business Research.

Speech Topic: *Weathering the Storms Impacting Agribusiness: Examining Some Suggestions*

Dr. Saikou E. Sanyang

Director General, Department of Agriculture, Ministry of Agriculture, Gambia

Dr. Saikou E. Sanyang is a Gambian Scientist currently served as the Director General at Department of Agriculture (DOA), Ministry of Agriculture (MOA). DOA's mission is to help Gambian farmers with vegetable and rice productions. Right now, there are three active projects, Rice Value Chain Transformative Project (RVCTP), Regional Rice Value Chain and Resilience of Organization for Transformative Smallholder Agriculture Project (ROOTS).

After Dr. Sanyang received his Ph.D. in Agrobusiness, he started his career as District Extension Supervisor and followed by Monitoring and Training Officer, Regional Agriculture Director and Regional Field Coordinator at FAO. Dr. Sanyang used to be the Local Rights Program Manager in Action Aid International. Dr. Sanyang also have abundant experience in field of research and many scientific publications were published in famous journals.

Speech Topic: *Family Enterprise in Agriculture the Gambia*

Dr. Chia-Lin Chang

Vice President, International Affairs, National Chung Hsing University, Taiwan

Chia-Lin Chang holds a PhD (Economics), 2004, Université Catholique de Louvain, Belgium, is an elected Fellow of the Modelling and Simulation Society of Australia and New Zealand (FMSSANZ).

Chia-Lin Chang is Vice President for International Affairs, a University Distinguished Professor, Professor of Economics, Professor of Finance, and Director of the Agricultural and Natural Resources Research Centre (ANRRC) at National Chung Hsing University, Taiwan, Distinguished Visiting Professor in the Faculty of Economic and Financial Sciences, University of Johannesburg, South Africa, and Adjunct Professor, Department of Economic Analysis and ICAE, Complutense University of Madrid (founded 1293), Spain.

Speech Topic: *The Global Impact on the World Economies and Agricultural Trade During Pre- and Post- COVID-19 Pandemic*

Dr. Kothandapani Ganesh

Senior Knowledge Expert & Global Lead, MSC-X, McKiney Knowledge Center (McKC), McKinsey & Company, India

Dr. Kothandapani Ganesh is the Knowledge Expert and Global Head of MSC Center of Competence at McKinsey & Company. Dr. Ganesh holds a Doctoral Degree in Logistics and Supply Chain Management at the Indian Institute of Technology Madras.

Dr. Ganesh has 16 years of research and consulting experience in the supply chain domain. He served as an Assistant Consultant at Integrated Supply Chain, Manufacturing Industry Solutions Unit, Tata Consultancy Services Limited, Mumbai and worked mainly in the areas of supply chain network design and optimization. Later he joined as Senior Consultant in Global Business Services-Global Delivery of IBM India Private Limited, Mumbai, India and worked in Supply Chain Transformation projects for various industries.

He has published over 100 papers in leading international research journals and more than 10 papers in leading national journals. He has been honored with 4 awards for academic excellence and obtained 3 awards from TCS. He is also on the editorial board for various international journals. He is the editor-in-chief for 5 International journals including the International Journal of Supply Chain Management and International Journal of Decision Making in Supply Chain and Logistics.

Speech Topic: *Prespetive on Digital & Analytics in Agriculture*

Dr. Ville Isoherranen
Director and ADJ. Professor, School of Engineering and Natural Resources, Oulu University of Applied Sciences (OUAS), Finland

Dr. Ville Isoherranen (D.Sc. (Tech.)) is the Director of School of Engineering and Natural Resources at the Oulu University of Applied Sciences, Oulu, Finland. Dr. Isoherranen is also Adjunct Professor at the Faculty of Technology, Industrial Engineering and Management at the University of Oulu, Oulu, Finland. Dr. Isoherranen's research interests are strategic management, operational excellence, knowledge-based management, and customer-focused enterprises. School of Engineering and Natural Resources has c.a. 150 education and RDI professionals, and c.a. 2300 students in 7 engineering degrees (Bachelor) and in 1 agricultural degree (Bachelor), and 9 Master's degree programs. School as annual RDI programs volume around 5 MEur with more than 50 RDI projects in the portfolio. Dr. Isoherranen has extensive international experience from leadership positions from several business functions both from global corporations as well as in technology start-ups.

Speech Topic: *OUAS Research, Development and Innovation (RDI) Projects in Agriculture: Towards Low Carbon Society*

Ms. Shya-Li Alice Chou

Vice President, Vice President Office, Taiwan Institute of Economic Research, Taiwan

Ms. Alice Chou received her M.S. degree of computer science from the college of William and Mary in Virginia USA. And she studied senior business programs from UC Berkeley and Sloan school of management of MIT USA. She worked for Taiwan Institute of Economic Research since 1988. For these thirty-three years, she was the chief Liberian, the chief of Department of Industrial Development and now the Vice president. She is holding many government projects in telecommunication industry, meeting and exhibition industry, branding industry, agriculture, industry transformation and innovation fields etc.

Since 2005, Ms. Chou assisted Council of Agriculture to establish the mechanism of Agriculture Technology Program (ATP) and develop the performance evaluation method for the program. The ATPs help Taiwan's agriculture to improve many traditional agriculture development problems. The circular economy is the global trend and is also one of the main important policies for the Taiwan government. And Ms. Chou is the project leader of "the industry analysis and promotion for the circular agriculture in Taiwan" since 2017.

Speech Topic: *Multidisciplinary Recycling: A Practical Strategy for the Development of Circular Agriculture in Taiwan*

Dr. Wei Fang

Professor, Department of Biomechatronics Engineering, National Taiwan University, Taiwan

Wei Fang is a Professor of the Department of Biomechatronics Engineering and the Director of the Center of Excellence for Controlled Environment Agriculture (CCEA) of National Taiwan University. He is one of the international consultants for the Japanese Plant Factory Association (JPFA) and the Chief Consultant of Chung-Hwa Plant Factory Association (CHPFA) of Taiwan.

Speech Topic: *Agroecology - Circular Food and Agriculture Systems*

Mr. Horng-Yuh Guo

Retired Soil Scientist and Director, Agricultural Chemistry Division, Taiwan Agricultural Research Institute, Taiwan

Mr. Horng-Yuh Guo is the emeritus research fellow in Taiwan Agricultural Research Institute, COA. His research field includes soil survey, land evaluation and utilization planning, soil fertility and soil improvement.

He started his research on the soil field in the university and joined the department of soil and environmental sciences at the National Chung Hsing University as an assistant research fellow after he finished the postgraduate studies. Then, he entered the Taiwan Agricultural Research Institute and was in charge of several soil research projects. During 37 years of work experiences in the Taiwan Agricultural Research Institute, Mr. Horng-Yuh Guo spent most of his time collecting and sampling the soil around Taiwan. He also contributed to establishing the digital platform for soil data in Taiwan and also the first soil museum in Taiwan in which was opened in 2004.

Speech Topic: *Progressing of Smart Agriculture in Taiwan*

Dr. Ravi Khetarpal

Executive Secretary, Asia-Pacific Association of Agricultural Research Institution (APPARI), Thailand

Dr. Ravi Khetarpal is the Executive Secretary of Asia Pacific Association of Agricultural Research Institutions (APAARI) since 2017 and is engaged in strengthening agri-food research and innovation system in ASIA-Pacific. He had also worked as Regional Director, CABI -South Asia for 7 years and for NARS in India for three decades. He is currently serving as the Chairman of Tropical Agricultural Platform of FAO - a G20 initiative for developing and promoting the Agricultural Innovation System. He holds PhD in Life Sciences (Plant Pathology) from University of Paris and was a Visiting Scientist in an EU Collaborative Project at INRA, Versailles, France for three years. His own areas of interest include management of research, development, innovation, policy issues and capacity building in the field of biosecurity, biosafety, seed certification, germplasm health and compliances to SPS Agreement of WTO. Among the various projects that he is executing there are two sponsored by STDF/ WTO and two by USDA which deals with phytosanitary and pesticide issues related to capacity building, partnerships, regulatory harmonization and quarantine and trade for South and South East Asian countries.

Speech Topic: *Strengthened Research and Innovations for Sustainable Agricultural Development in Asia and the Pacific*

Dr. Nen-Fu Huang

Dean and Professor, College of Electrical Engineering and Computer Science, National Tsing Hua University, Taiwan

Nen-Fu (Fred) Huang received the Ph.D. degree in computer science from National Tsing Hua University (NTHU), Taiwan, in 1986. He is now serving as the Dean of EECS College of NTHU. From 1997-2000, he was the Chairman of Department of Computer Science, NTHU. His current research interests include Internet of Things (IoT) sensor networks, AIoT-based Smart Agriculture and agriculture blockchain, AI-based crops classification technologies, LPWAN (LoRaWAN/NB-IoT) transmission technologies and applications, AI-based Big Data Analysis for MOOCs (Massive Open Online Courses), network security, and SDN/NFV networks. He was the founder/ CEO/Chairman of Broadweb Corp. (a network security company), which was acquired by TrendMicro, an international security company, in 2013. He is also the founder of ShareCourse, an AI-based MOOCs platform (www.sharecourse.net), which provides MOOC courses including IoT, AI, Big Data Analysis, FinTech, Robot related courses. Dr. Huang has published more than 200 journal and conference papers, including more than 50 papers in IEEE INFOCOM/ICC/GLOBECOM flag-ship conferences. Dr. Huang also has granted/pending more than 60 patents. He is a Fellow of the BCS (British Computer Society) and a senior member of the IEEE.

Speech Topic: *Smart Paddy Irrigation Systems*

Dr. Mohd Nasir Mohd Desa
Director, Halal Products Research Institute, University Putra Malaysia, Malaysia

Dr. Mohd Nasir obtained his first degree in Microbiology from University of Arizona, USA, and both Master of Medical Science and PhD in Medical Microbiology from Faculty of Medicine, University of Malaya. He started his academic career at Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, presently as an Associate Professor. He is also currently registered at Malaysian Board of Technologists as a Professional Technologist in Biotechnology. He has been on secondment at Halal Products Research Institute, Universiti Putra Malaysia since 2015, previously as the laboratory head specializing in DNA-based meat spp. authentication and now as the Director.

Speech Topic: *Halal Management and Certification; the Malaysian Scenario*

Mr. Fahad S. Damanhouri

Manager, Business Development, Makkah Chamber of Commerce and Industry, Saudi Arabia

Fahad Damanhouri is the Manager of international collaboration and business center at Makkah Chamber of Commerce and Industries. From the year 2011 to 2013, Damanhouri studied Bachelors of Business in Human Resources Management at Bond University, Australia. After that, he was seeking a challenging role to further develop his management and business experience.

From 2014 to 2016, he was the Director of human resource management at Chamber of Commerce and Industries in Makkah, and built and maintained networks with all consulates and embassies.

Speech Topic: *Introduction and Trend of Halal Process in the Kingdom of Saudi Arabia*

Ms. Joanna Kane-Potaka

Assistant Director General, External Relations of Strategic Marketing & Communication, International Research Institute for the Semi-Arid Tropics (ICRISAT), India

Joanna Kane-Potaka is a marketing specialist and currently Assistant Director General at ICRISAT and Executive Director of Smart Food. She has worked largely in agriculture and food, including with four international nonprofit organizations working in Sri Lanka, Italy, Malaysia, the Philippines, Australia and currently India. The Smart Food initiative is a global movement to bring foods that are 'good for you, the planet and the farmer' into mainstream. One key objective in this is to bring millets and sorghum back as a staple food across Asia and Africa and to make it a global commodity.

Speech Topic: *Leveraging the UN International Year of Millets 2023*

Dr. Mari Maeda-Yamamoto

Senior Principal Scientist, National Agriculture and Food Research Organization (NARO), Japan

Dr. Mari Maeda-Yamamoto is a Principal Scientist at the National Agriculture and Food Research Organization (NARO) and Professor at University of Tsukuba, Japan. Her research interests are studying on physiological functions of green tea, especially in immunological regulation and developments of functional agricultural foods.

Dr. Yamamoto used to be a chief researcher in Ministry of Agriculture, Forestry and Fisheries (MAFF) after received her PhD degree in Kyushu University and play an important role in NARO since 2002 as being a director of Food Function Research Division, Agri-Food Business Innovation Center and Healthcare Innovation Research. In recent years, her expertise of studying on green tea and developments of new functional food has been recognized and received many awards, including Food Immunology Industrial Award and Japan Agriculture Award from Japanese Association for Food Immunology and Japanese Association for Agriculture in 2016 and 2018, respectively.

Speech Topic: *The Current Status of Self-care Initiatives Using Functional Agricultural Products in Japan*

Dr. Tian-Zhu Zhang
Professor, College of Water Resources & Civil Engineering, China Agricultural University, China

Professor Zhang is the Professor at China Agricultural University (China). He is also the General Manager at Beijing Futong Environmental Engineering Co. Ltd., China.

Taken charge and participated in more than 220 planning projects of agricultural parks and areas. Since 1995, over 61 papers have been published, and 41 of them were published as the first author.

Speech Topic: *Applications and Challenges of ESG in China's Agriculture*

Dr. Vijay P. Singh

Distinguished Professor, Department of Biological and Agricultural Engineering & Zachry Department of Civil Engineering, Texas A&M University, USA

Dr. Vijay P. Singh is a Distinguished Professor and holds the Caroline and William N. Lehrer Distinguished Chair in Water Engineering at Texas A&M University. His research interests include Surface-water Hydrology, Groundwater Hydrology, Hydraulics, Irrigation Engineering, Environmental Quality and Water Resources.

Speech Topic: *Irrigated Agriculture for Food Security*

Mr. Min-Hung (Richard) Chen
President, Greenday Biotech Inc., Taiwan

In 1978, Mr. Min-Hung Chen graduated from National Taiwan University, majored in Microbiology. He worked for multinational corporation (like Eli Lilly, Bristol Meyer etc) for more than fifteen years. Then he set up his own company, Zatech Corporation at Taiwan in 1992, which is a importer of Animal Health and supplementary products. GreenDay BIOTECH INC. is set up in 2015 for the disposal and recycling of animal wastes. Our target is to recycle all animal and plant wastes to useful products using “Microbiotech”!

Speech Topic: *High Speed Chicken Waste Disposal Machine*

Mr. Poyu (Brian) Chen

Executive Director, Rolling Greens Co. Ltd., Taiwan

Mr. Chen works in Rolling Greens Co., Ltd and is engaged in the research of environmentally friendly fertilizers and Bioproducts.

RollingGreens is a company that develop and manufacture affordable environmental friendly fertilizers and bioproducts. RollingGreens' goal is to achieve agricultural sustainability and help improving growers' living standards, with our help, growers can produce more with less. RollingGreens has expanded its markets to various countries and places including China, India, Indonesia, and Thailand.

Speech Topic: *Lil Heroes in the Soil*

Mr. Mark Lan

Conference Specialist, Jia Wen Cing Light Ooling Tea Shop, Taiwan

Mr. Mark Lan is hired as a conference specialist to represent JWC to give the presentation in the IAIC 2021, and he would be glad to assist in the QA session as an English/Chinese interpreter for JWC executives.

Speech Topic: *Combination of Taiwan Agricultural Products and Hand-shaken Drinks*

Dr. Chien-Liang Kuo

C.M.D., Nutritionist, Food technician, Taiwan

Doctor Kuo is the Master of Medicine degree holder, currently in the PhD program for Aging at China Medical University, Taiwan.

He is also a qualified TCM practitioner, nutritionist, and food technologist. He specializes in immunomodulation, preventive healthcare, and oncotherapy. Devoted to producing top-quality herb products, he is now leading the R&D team of AgriGADA Biotech and responsible for quality control.

Speech Topic: *Sustainable Production of Natural Anti-inflammatory Substances: Take Antrodia cinnamomea as An Example*

Mr. Johnny Tu

CEO, Hwa Gung Tea Co. Ltd., Taiwan

Mr. Johnny Tu is the 4th generation of "Chuan-Fang Tea Shop in Taiwan. He is also the CEO of Hwa Gung Tea Co., Ltd.

In the year of 2018, Mr. Tu was elected as the Honored 2018 "100 MVP Managers". Moreover, he also achieved the Honor of "Outstanding Social Youth of 2020."

He graduated from Department of Economics, Soochow University.

Speech Topic: *The Inheritance and Innovation of Taiwan's Local Tea Industry for a hundred Years*

Panel Discussion

Mr. Toshihiko Takatani

Representative Director, Jisedai Ichijisangyo Jissenjo (Next Generation Primary Industry Practice) Corp.

Majored in organic chemistry at Osaka University Graduate School. After graduation, joined Suntory Ltd. in 1998. He was in charge of developing brewing technology for whiskey, beer, wine, etc. at Suntory's Basic Research Laboratories and Liquor Research Laboratories.

After that, he worked at Iwanohara Grape Firm and was engaged in the cultivation of grapes for brewing and the development of brewing technology in Japan.

He has been promoting the development of recycling-oriented agriculture using local unused resources and smart technology for labor-saving farming as not only the Vice President of Nature Dyne Inc. but also Representative Director of "Jisedai Ichijisangyo Jissenjo (Next Generation Primary Industry Practice)" Corp.

Dr. Yves Waché
Professor, Microbiology and Biotechnology, Agrosup Dijon, France

Yves Waché is a professor at AgroSup Dijon (France). He is co-chair of the International Joint Research Laboratory Tropical Bioresources & Biotechnology between Hanoi University of Science & Technology, AgroSup Dijon and the University of Burgundy and has a Bualuang Asean Chair Professorship at Thammasat University (Thailand). He is interested in fermentation, from traditional ones to new products and to the valorization of agriculture by-products.

Mr. Seiya Ashikari

CEO, Ecologgie Inc., Japan

After graduating from the School of Commerce at Waseda University, he entered the Graduate School of Advanced Science and Engineering at Waseda.

Founded ECOLOGGIE, Inc. in 2017, he has established a system to more quickly reproduce the cricket, a nutrient-rich insect that is attracting the attention of the United Nations as a food resource for the next generation. The system can arrange and reproduce various 'patterns' of crickets according to expected purposes, such as aquaculture feeds, healthcare products and so on, aiming to contribute to environmentally sustainable society by providing essential nutrients including protein in a different and economical manner.

Currently living in Cambodia, and has received many awards, including being selected for the Forbes 30 Under 30 Japan (2019).

Dr. Annie Koh

Professor Emeritus, Lee Kong Chian School of Business of Singapore Management University (SMU), Singapore

Prof. Annie Koh is the Academic Director of the School of Family Business and the School of International Trade, two research institutes of the Singapore Management University. She has held positions at the World Economic Forum, the Singapore Government Science and Technology Agency, the Monetary Authority of Singapore, the Suncon Group, Stashaway Intelligent Investment Consulting and Staff-on-Demand Human Resource Technology Services.

Mr. Ankesh Shahra

Founder and CEO, Agrimax Ventures, Singapore

Mr. Ankesh Shahra is the Founder and CEO of Agrimax Ventures. This Singapore headquartered company develops, operates and/or invests in businesses that can bridge inefficiencies and imbalances in the food and agricultural input space. A systematic adoption of smart technology is imperative in order to be able to face the challenges posed by climate change, and Agrimax Ventures firmly believes in collaboration with like-minded partners to achieve these goals.

Mr. Ho Ren Hua

CEO, Thai Wah Public Company, Singapore

Ren is currently the Chief Executive Officer of Thai Wah Public Company and is responsible for developing the company's long-term vision as a leading starch and consumer foods company in Southeast Asia. Since its founding in 1947, Thai Wah has been a leading pioneer in the starch and food industry now expanding its footprint to Vietnam, Cambodia, Indonesia and China. In 2017, in recognition of Thai Wah Group's sustainability and community efforts across the region, Ren was awarded the "Outstanding Leader in Asia" award at the 4th Asia Corporate Excellence and Sustainability Awards and was selected in 2018 to be a World Economic Forum Young Global Leader.

Ms. Hidemi Masuda

Senior Managing Director, Masuda Seed Co. Ltd., Japan

After graduating from Seijo University with a degree in European Culture, joined Yanase & Co. Ltd.

Married the current CEO of Masuda Seeds Co. Ltd., a seed manufacturer specializing in cruciferous vegetables with a history of about 100 years.

In 1990, she newly developed the world's first non-heading Brussels sprouts, a new vegetable that was highly regarded for its nutritional value and taste, and named it "Petit Vert".

Appointed as a Senior, Managing Director of the company in 2008.

Mr. Takuro Nagahara
President and Representative Director, Kimise Brewery Co. Ltd., Japan

Mr. Nagahara graduated from the Faculty of Commerce, Keio University, in 1991, and joined Resona (formerly Daiwa) Bank.

After having been involved in the bank's investment activities in bonds, securities and FX, he changed places to the Singapore Office. After returning to Japan, he was responsible for the bank's currency options and FX.

In 1998, he left the company and joined his family business, Kimise Shoyu (Brewery) Co. Ltd., one of the few companies in Japan that brew soy sauce made of only natural ingredients. The philosophy of the family business is that it must provide only the products that are tasty and good for health for the customer at a reasonable price. The following year, he was appointed Managing Director, and in 2010 he became the fifth owner-manager of the company.

Dr. Hironori Higashide

Professor, Waseda Business School (Graduate School of Business and Finance), Waseda University, Japan

Professor, Entrepreneurship, WASEDA Business School.

Director, WASEDA Entrepreneurship Research Unit (WERU).

Director, WERU Investment Ltd., Waseda university-related venture capital fund, as well as Entrepreneurs' alumni association of Waseda University.

MBA and Ph.D. in Entrepreneurship, Imperial College, University of London.

Dr. Pensri Jaroenwanit

Dean and Associate Professor, Faculty of Business Administration and Accountancy, Khon Kaen Business School, Khon Kaen University, Thailand

Professor Pensri Jaroenwanit received her B.S. in Agriculture, at Kasetsart University, Thailand. Later, she received her M.B.A. at the National Institute of Development Administration-NIDA Business School. Moreover, she received her Ph.D. at Thammasat University, Thailand, Marketing, in the year of 2009.

Dr. Kuei-Son Sheu

Convener of African Swine Fever Working and Counselor, Council of Agriculture, Taiwan

Director Kuei-Son Sheu has been the Director of the International Center for Land Policy Studies and Training (ICLPST) in Taiwan since September 2016. He is also the Convener of the African Swine Fever Working Group, Council of Agriculture (COA) in Taiwan.

He has many years of experience in the field of Agriculture. Before he became the Director of the International Center for Land Policy Studies and Training, he was the Former Director General at the Council of Agriculture across various departments, including the International Affairs Department and the Animal Industry Department.

Dr. Ho-Hsien Chen

Dean and Professor, College of Agriculture, National Pingtung University of Science and Technology, Taiwan

Dr. Henry Ho-Hsien Chen is now the Dean at National Pingtung University of Science and Technology. His Fields of Specialization are in Food Dehydration, Food Machinery Design, Supercritical CO2, Extraction, Renewable Energy, Grey Theory, and Control and Automation.

In 1996, Dr. Chen got his Ph.D. in the Department of Automatic Control and System Engineering in the University of Sheffield, United Kingdom; in addition, since 2005, he has been a professor at the Department of Food Science at National Pingtung University of Science and Technology.

Dr. Bayanjargal Darkhijav

Professor, Department of Applied Mathematics, School of Applied Science and Engineering, National University of Mongolia, Mongolia

Darkhijav Bayanjargal has been working at the National University of Mongolia since 1995. From 1997 to 2014, she was a lecturer and head of the Economic Information-Modeling department of the School of Economic Studies of National University of Mongolia. Since 2014, D. Bayanjargal has been working as a Professor of Applied Mathematics department of School of Applied Science and Engineering of the National University of Mongolia.

Dr. Jung-Kun Park
Professor, School of Business, Hanyang University, Seoul, Korea

Professor Jung-Kun Park is currently the professor of Business School at Hanyang University, Seoul, Korea. Before that, he was the associate professor at University of Houston, Texas, USA.

His teaching interests include: Retailing, Services Marketing, Consumer Behavior, E-tailing, Internet Marketing, Sales Management, and others.

Professor Park received his Ph.D. at the University of Tennessee, Knoxville, USA, and his Masters Degree at the University of Illinois, Urbana-Champaign, USA.

His research interests are: retail management, social media, online consumer behavior, mobile marketing, technologies and consumers, and more!

Dr. Huu-Sheng Lur

Dean and Professor, College of Bioresources & Agriculture, National Taiwan University, Taiwan

Professor Huu-Sheng Lur is now a professor at the Department of Agronomy, College of Bioresources and Agriculture, at National Taiwan University. Professor Lur got his B.S. in National Chung-Hsing University (1980), M.S. in National Taiwan University (1982), and Ph.D. in Cornell University (1990). His research areas are mainly: Crop Physiology, Agronomy, and Plant Molecular Biology.

Mr. Kohei Koide
President and CEO, Watami Organicland Co. Ltd., Japan

After completing graduate school at Chuo University in 1989, he joined Toda Corporation and worked on various projects such as the design of a pharmaceutical plant.

Received his MBA from Waseda Business School in 2003. After working for MISUMI Corporation, he was appointed as CEO of Watami Energy Corporation, an environmental business company that handles energy and resource recycling business.

Appointed as CEO of Watami Organic Land Co. Ltd. in Rikuzentakata City, Iwate Prefecture in 2007, which is one of the largest hands-on organic farming theme parks in Japan, and he has been serving till now.

Dr. Petr Skobelev

Professor and Head, Electronic Systems Department, Samara State Technical University, Russian Federation

Prof. Petr Skobelev is scientist, entrepreneur and software engineer, specialized in developing Artificial intelligence (AI) for solving extremely complex problems of adaptive resource management. The results of this work are critically important for making step to Industry 5.0 / Society 5.0, which will be based on digitalization of knowledge, formation of digital eco-systems of AI colonies and digital transformation of enterprises to talent-centric networks. The results for trucks and supply chains, factories and farming are better quality of services, high efficiency of resources, better scalability, performance and reliability of businesses. Together with Prof. G.Rzevski from Open University (UK, London) Petr was one of pioneers of multi-agent systems bringing them from research lab - to industrial applications.

Ms. Asako Shimazaki

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Participated as a foreign faculty member for adjudication to Indian Universities Scholar's PhD thesis.

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Sixth Industrialization Strategy to Promote Innovations among Tea Smallholders in Sri Lanka: Lessons from A Case in Saga, Japan

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Abstract

Sri Lanka is the third largest tea exporter in the world. About 90% of tea green leaves is converted into one product (orthodox black tea) and 57% of it is exported in bulk form. Three fourths of green tea leaves are coming from tea smallholders, who do not involve in processing and live with deprived standards. The lack of innovation has led to lower gains from tea export in Sri Lanka (4.58 US$/kg) compared countries like Japan (24 US$/kg) that convert the same green leaves into many different products. In recent times, Japan is promoting sixth industrialization to revitalize rural agricultural sector (raw material production $\times$ processing $\times$ sale/services). The objective of this paper is to determine the application of sixth industrialization to develop tea smallholders in Sri Lanka. We conducted an ethnographic case-study in a small-scale tea farm in Saga, Japan. We made the following observations in the farm: 1. Structure - intense use of land, labor and capital, advanced technology, 2. Strategy - horizontal and vertical diversification, value addition from field through processing, linking with value chain suppliers, processors and customers, market orientation and branding, 3. Skills - self-efficacy, passion for innovation and accumulation and sharing knowledge, and 4. Climate - policy framework and supportive institutes. The results revealed sixth industrialization directly contributed to innovations and stabilize high farm income. While recognizing limitations of full-scale application of these findings to Sri Lankan smallholders, further research and pilot scale projects are recommended to promote sixth industrialization, and therefore innovation and growth of tea industry in Sri Lanka.

Keywords: *Tea, Innovations, Smallholders, Sri Lanka, Japan*

1. Introduction

Tea, being the most consumed brewed beverage in the world, plays an important role in producing countries in terms of contribution to foreign exchange, GDP, and employment. For instance, in Sri Lanka, tea brings 12% of the total export earnings, contributes 0.7% to GDP and employs about 10% of its population. Tea was introduced by the British to Sri Lanka in 1867 and was cultivated in large plantations (tea estates) owned by the British companies. Sri Lankan government nationalized the large estates in 1970s giving rise to the establishment of tea small holding sector[1]. While the British management for Sri Lankan tea estates ceased by the 1970's the tea smallholdings sector became much popular among the people as a major livelihood. By 2018, tea small holdings sector covered 61% of the total tea lands (201,000 ha) in Sri Lanka (MPIEA, 2020).There were about 400,000 tea smallholdings whose average extent was 0.3 ha/holding. In general, the smallholders harvest tea using family and or hired labor and produce about 7500 kg of green leaves per hectare per annum. The harvested green leaves are sent to factories to convert into made tea. Since they do not involve in tea processing and innovation, these smallholders receive only a marginal gain of about 10% of the FOB price of the made tea. Not only smallholders, but large-scale tea processing factories and exporters also do not involve much in innovation. For instance, 91% of Sri Lankan tea exports constitute of one product namely orthodox black tea. During the last five years (2015-2019) Sri Lanka on average earned only 4.82 US$/kg from tea exports, while that was considerably high even in some tea non-producing countries. Apart from beverage type teas, there are hardly any non-beverage tea-based products produced in Sri Lanka.

Among all the tea producing countries in the world, Japan achieved the highest export gain (23.65 US$/kg) for its teas during 2015-2019 period. Japan produces green tea as its major tea beverage type[2]. Although Japan processes only about 25% of the amount of green leaves produced in Sri Lanka, it produces nearly 25 different innovative tea beverages and hundreds of non-beverage products (e.g. cosmetics, food supplements and confectionaries, etc.) from the same tea (*Camellia sinensis*) plant.

Saga prefecture is famous in Japanese tea history as the place where tea cultivation originated in 1191 (Brekell, 2018). Similar to Sri Lanka, Japan also has large-scale plantations as well as small-scale farmer families cultivating tea. However, unlike in Sri Lanka, most of the small tea growers involve in tea processing. They produce different types of innovative beverage teas and non-beverage products. It is obvious that most of these innovations are not overnight products but are results of lots of thinking and hard work of the entrepreneurs,

[1] In general, private ownerships of tea lands below 20 ha are called as smallholdings.

[2] *Sencha* accounts for 58% of the total tea production.

under the correct institutional support. For example, recently Ministry of Agriculture, Forestry and Fisheries in Japan implemented a special project named "sixth industrialization" [3] in order to promote regional innovations in agriculture including tea. Under this, primary agricultural production (primary industry) is integrated with processing (secondary industry) and services (tertiary industry). We believe this Japanese sixth industrialization strategy used to promote rural innovations have potential applications in promoting tea-based innovations the tea smallholdings sector in Sri Lanka. With this as a background, we forward the objective of this study as to identify the possibilities of implementing the sixth industrialization strategy to improve product and process innovations in the tea smallholdings sector in Sri Lanka.

2. Methodology

Through a literature survey, we identified four key features and 16 sub-features needed for successful implementation of sixth industrialization strategy namely: 1. Structure, 2. Strategy, 3. Skills and 4. Supportive institutions. "Structure" consists of the features related to basic factors production that the firm owns (1. intense use of land/labor and capital and 2. application of advanced technology). We categorized the series of decisions and actions that match firm's tangible and intangible resources to acquire organizational goals as "Strategy" (1. horizontal diversification, 2. vertical diversification, 3. connecting different types of industries-economies of linkage, 4. value addition from the filed throughout processing, 5. local branding, 6. establish direct contacts with the end user and 7. market orientation). "Skills" consist of features related to entrepreneurial traits and knowledge accumulation that we observed (1. self-efficacy, 2. passion for innovation and 3. accumulation and sharing knowledge) while "Supportive institution" includes the key features related to external environment such as policy framework and related organizations (1. Education, 2. Research and 3. Financial Institutes).

This study is based on an ethnographic case study of a farm run by father, mother (2nd generation) and son (3rd generation) in Saga Prefecture, Japan. According to (Yin, 2018), case studies suit best when the research questions are exploratory type in nature (i.e. "how" and "why"). We name this farm as "X" from here onwards. The data collection is composed of two methods: 1) in-depth discussions and 2) ethnographic study lasted one month at farm X (in January and April 2021). We tape recorded all the discussion sessions and analyzed the responses with respect to the key features that we identified in the sixth industry framework.

[3] Sixth industry = primary industry x secondary industry x tertiary industry. Under sixth industry, farmers not only supply raw material (primary industry), but also take part in processing or manufacturing (secondary industry) as well as distribution and sales (tertiary industry) (Ministry of Agriculture Forestry and Fisheries Japan, 2017).

3. Results and Discussion

3.1 Case-study: Sixth industrialization in promoting product innovation

As presented in Table 1, father of the family that owns farm X (71 years, 2nd generation), who is coming from a traditional tea growing family joined with his parents to cultivate at his early 20s in 1970s. At that time, the farm had 0.4 ha of tea land and a 1.5 ha of paddy field and 1 ha of Manderin (*Citrus unshiu*). One can claim that this situation represents the present situation of tea smallholders who owns about 2-3 ha of land in Sri Lanka. In 1980, father bought a used greenhouse (0.1 ha in extent) and started cultivating vegetables. Son joined the farm full-time in 2000. Later, part of the vegetables in the greenhouse was replaced by traditional mandarin cultivar, and then in 2010, it was replaced by a hybrid mandarin cultivar.

The farm X bought another 2.5 ha of land and planted new tea cultivar in 2000. Since the farm had already started producing different crops (i.e. tea, rice, garlic, vegetables and mandarin) by that time, the Prefectural Industrial Center suggested idea of establishing a food processing unit. In 2010/2011, the farm started a food processing unit where the mother started involving full-time in the business. Further, as per their suggestion, the farm replaced 2/3rd of the paddy land with wheat and black rice.

Table 1 Time line of the farm X

Period	Major structural changes
1970	Father (2nd generation) succeeded to take over the cultivations maintained by his parents (1st generation)
1980	Father bought a used greenhouse (0.1 ha) and started cultivating vegetables
2000	Son (3rd generation) starts management of the farm X Replaced vegetables in the greenhouse by traditional Mandarin cultivar Mechanized tea lands Cultivation of exotic vegetables including giant garlic Replaced the traditional mandarin cultivar (1 ha) with new tea cultivar
2002	Bought an old tea land (1.5 ha) and replanted with new cultivar Replaced one third of the paddy land (0.5 ha) by black rice
2010/2011	Mother joined the farm-full time and started the food processing unit Launched own brand One third of the paddy field was replaced with wheat (0.5 hectare)

Source: Author's elaboration

3.1.1 Structure

By 2021, X farm occupies in 5 ha of land for tea (2.9 ha), rice/wheat (1.5 ha), mandarin (0.1 ha), vegetables and cut flowers (0.5 ha). Tea, the main crop out of the six, covers more than half of the total cultivated land (63%). The farm basically depends on family labor (son,

father and mother) and completely mechanized all the agricultural practices in the farm.

3.1.2 Strategy

Producing different types of raw material is horizontal diversification. Using raw materials produced, farm X processes about 15 different types of products. This is vertical diversification. For example, tea green leaves are converted into two types of made teas: *Tamaryokucha* and *Sencha*. Further, the farm use tea leave powder mixed with own wheat flour to process into confectionaries such as tea-cake, tea-bread and *karinto*. The sub-features of strategy observed in farm X is summarized in Table 2.

Table 2 Product list by X farm

Horizontal Diversification	Vertical Diversification	Other sub-features under strategy
Tea	*Tamaryokucha, Sencha,* Tea-Jelly	• Value addition from field to processing • Products are sold at famer's market (Road-side-stations), supermarkets and JA (Japanese Agriculture Cooperative) under Brand X. • Connections with customers at road-side-stations to come up with customer-oriented products. • Forward linkages (e.g. Saga JA green tea factory, beef cattle farm) and backward linkages (e.g. egg producer)
Tea and Wheat	Tea-cake, tea-bread, *Karinto*	
Wheat and mandarin	Mandarin-cake	
Wheat and black rice	Black rice bread	
Mandarin	Packaged Mandarin, Candied peel, Jam	
Black rice	Packaged black rice,	
Black rice and vegetables	Lunch parcels	
Vegetables	Packaged vegetables	
Garlic	Processed black garlic	
Cut flowers	Cut flower arrangements	
Rice	Silage for beef cattle farm	

Source: Authors' observations in the case study

3.1.3 Skills

Under "skills" we observed accumulation and sharing of knowledge, self-efficacy, passion for innovation of mother who mainly involved in food processing. Initially she gained explicit knowledge on bakery products (cakes and cookies) from a resource person introduced by the Prefectural Industrial Center. Gradually she started producing different products adding different flavors using her tacit knowledge. This clearly shows incorporation of both explicit knowledge and tacit knowledge in producing food innovations at farm X (i.e. self-efficacy).

According to Kuhne et al. (2013) and Avermaete & Viaene (2002), knowledge shared through interactions play a significant role particularly in food and beverage innovations. The mother was motivated to process irregular shaped Mandarin that cannot be sold into jam by another farmer who supplied home-made strawberry jam to a roadside station. This clearly

explains how the informal links help share and exchange knowledge particularly in a low-tech industry in rural areas.

3.1.4 Supportive Institutes

The Ministry of Agriculture, Forestry and Fisheries in Japan (MAFF) established the sixth industrialization act in March 2011. The act consisted of four main activities as: 1. formulation of strategies regarding agriculture/forestry or fisheries innovations (municipal strategy), 2. provide subsidies for networking, 3. provide subsidies for personal training and development, and 4. provide interest free loans to purchase capital requirements.

Under the act, first the Prefectural Industrial Center suggested the farm X to establish a food processing unit attached to the farm. Next, they linked the farm with expertise regarding implementation (e.g. a university Professor on food processing). Thirdly, mother received a free intensive course on food processing under training and development. The government completely paid the venue fee, text preparation fee, lectures' fee, lecturer's travel expenses etc. Fourthly, the farm X received interest free loans to purchase capital goods (i.e. agricultural machinery, tea leave grinding machine, cookers, etc.).

3.2 Possible application of sixth industrialization to tea smallholders in Sri Lanka

We will highlight the issues in the tea smallholdings sector in Sri Lanka under above four sub-headings (structure, strategy, skills, and supportive institutes) and discuss how the sixth industrialization could be applied to boost tea-based innovations by correctly addressing these issues.

In Sri Lanka, out of the total, 88% of the smallholders have extent less than 0.5 ha (51% of the total tea extent under the small-holdings sector). The extents under 0.5-1 ha, 1-2 ha and above 2 ha were 17%, 8% and 24% respectively (Ministry of Plantation Industries and Export Agriculture, 2020). The smallholders having more than 2 ha can be initially considered as a potential group to implement sixth industrialization while smaller farmers should be collectivized to implement the same. However, due to lack of attention on land preparation, most of the tea lands are in steep slopes limiting possibility of mechanization. This led to limited availability of labor for secondary and tertiary industries. Therefore, land preparation in order to support mechanization and development of appropriate technology for steep terrain is a must to support the sixth industrialization.

In 2005, 66% of tea land was cultivated as a mono crop. Out of the smallholders who have intercropped, majority have cultivated, coconut (17%) and rubber (9%), minor export crops (mainly pepper) (3%) and other (5%). The main purpose of intercropping is to provide

shade to the tea plants rather than horizontal diversification. Under strategy, to promote sixth industrialization, horizontal and vertical diversification should be the first step. The possible areas for tea-product innovations include, wild teas, organic teas, hand-made teas with different flavors and mixes for beverage types, and tea cake, cookies, jelly etc. There is a great demand for ginger tea, cinnamon tea, vanilla tea in both domestic and international markets. Therefore, stallholders can be promoted to growth other crops that can be used to come up with different types of innovations as in the case of farm X. Since, Ceylon tea has already established market and recognized as a top-tourist destination (before the pandemic), come up with an own brand and marketing them in both domestic and international markets will not be a that hard.

As per the skills, as mentioned above, smallholders do not involve in processing and their role is only to supply green leaves. A survey done in 2005, indicated majority (67%) of smallholders belonged to middle 26-55 years' age group. They were educated up to high school level. Since, tea processing is neither tradition nor learnt, attitude change towards innovation and conducting professional courses on food processing will be imperative to promote sixth industrialization.

As per the support organizations, there are three national bodies in Sri Lanka that particularly work on tea: 1) Tea Smallholdings Development Authority, 2) Tea Research Institute and 3) the Sri Lanka Tea Board. Tea board is responsible for the development, regulation, and promotion of Sri Lankan tea. The Tea Research Institute is responsible for generating and disseminating of new technologies related to cultivation and processing of tea. Among these three, the TSHDA deals closely with the tea smallholders which handles extension. According to our observations, policy, research and the technology development and extension of these three organizations have been focused only on increasing the orthodox black tea output of the country (scale economies) than number of products and innovations (economies of scope). A radical change in policy, mandate and leadership of these three organizations is necessary to maintain the sustainability of the tea industry in Sri Lanka.

4. Conclusions

Our case study revealed that sixth industrialization helped increase the product innovations using local resources. Under the sixth industrialization project, first the government (Prefectural Industrial Centers) identified potential farmers and helped them with formulating strategies that suits best for their businesses. Next, they developed the required human capital by providing training and development for farmers. At the same time, the roadside stations (farmers' markets) were established by JA and other organizations to bring more benefits to the farmers. Therefore, success of this case i.e. farm X is arising from a

correct collaboration of structure (resources), strategy (actions and decisions), skills of the entrepreneur under the strong government support (supportive institutes).

Based on our study, we forward our suggestions as follows. Since labor being a series issue that directly impacts quality raw material production for innovations, mechanization is a must. Ginger, cinnamon, flowers, and fruit trees can be grown as a mixed crop or in separate lands along with tea. At the beginning focus should be given to two groups. Smallholders having larger tea extents and other resources can be promoted implement community type sixth industrialization, while smaller groups having harmonious cohesion should be collectivized to form franchise type sixth industrialization businesses. These two farmers with necessary resources can be promoted to produce different types and beverage and non-beverage tea products, and market them by themselves. These businesses can also be linked to established beverage, food, confectionary and cosmetic producers to promote tea-based innovations.

Professional courses for entrepreneurs on tea-based innovation and entrepreneurship can be offered via universities and the Tea Research Institute and TSHDA in order to change attitudes and skill. Sri Lankan tea industry needs a policy level change from its current focus of economies of scale to economies of scope. Therefore, we believe a policy level intervention like sixth industrialization would create a new focus through innovations where the country as a whole and the tea smallholders in particular can directly enjoy the benefits.

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Organomineral Supplement for Poultry Feeding

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Abstract

The purpose of the experiment was to evaluate the effectiveness of the combined use of copper and arginine nanoparticles in the diet of broiler chickens. The experiment was carried out on Smena 8 broiler crosses. At the age of 11 days (n = 90) they were divided into 3 groups (n = 30 each). At the age of 15 days, poultry from group II were daily supplemented with copper nanoparticles (4 mg/kg feed), chickens of group III were supplemented with copper nanoparticles (4 mg/kg feed) and arginine (10 g/kg feed). The introduction of copper nanoparticles into the diet increased the live weight of chickens by 6.6% in comparison with the control. The combined use of nanoparticles of copper and arginine together increased the live weight of poultry by 9.8% in comparison with the control. The use of nanoparticles promoted the activation of the immune response, which was expressed in an increase in monocytes in the blood serum in groups II and III by 4 and 2.7 %. An increase in NO-metabolites in the blood and liver of poultry of group II by 8.66 and 3.8 %, in III by 8.01 and 2.1% was revealed. There was an increase in the content of arginine in the liver of poultry of group II by 3.6 %. Nevertheless, the use of copper nanoparticles together with arginine in diet of broiler chickens was more effective and expedient.

Keywords: *copper nanoparticles, arginine, productivity, broiler chickens*

1. Introduction

The increasing demand for poultry products sets the task of creating new feed additives that will effectively influence on the yield of poultry. Mineral feed additives based on nanoparticles, including metals, have shown high potential for their use in animal husbandry in recent decades (Gangadoo et al., 2020; Hassan, Hassan & Rehman, 2020; Patra & Lalhriatpuii, 2020). Metal nanoparticles are more bioavailable, more reactive, and more effective than traditional inorganic and organic forms in animal husbandry (Shafi, Kumar, Jadhav & Kar, 2020; Lee et al., 2021). The use of a number of heavy metals, including copper, in nanoparticle form reduces its release to the environment during animal rearing (Scott, Vadalasetty, Chwalibog & Sawosz, 2018; Anwar, Awais, Akhtar, Navid & Muhammad, 2019). Copper is involved in many physiological processes in the body and is one of the key trace elements in the body (Cholewińska, Fotschki, Zduńczyk & Juśkiewicz, 2018; Sawosz et al., 2018). The use of copper nanoparticles in feeding has shown the effectiveness of its use in relation to the immune defense of the body of poultry and productivity in comparison with other forms of copper (El-Kassas et al., 2018; Ogniket al., 2018). Nevertheless, a number of studies on toxicology show the drawbacks in the use of copper nanoparticles and the need to mitigate the adverse effects (Ameh & Sayes, 2019; Ouni et al., 2020). The use of copper nanoparticles in the composition of an organomineral additive based on arginine seems to be promising. It is known that arginine is not only a building block for increasing the body weight of poultry, but is also capable of exerting a powerful antioxidant effect on the body (Wu et al., 2016; Zheng et al., 2020). Previous studies have shown that the use of additional amounts of arginine in the diet of broiler chickens led to an increase in poultry live weight gain up to 6%, which was explained by the key role of arginine in regulating the growth of young animals (Yausheva, Miroshnikov, Kosyan & Sizova, 2016). In this regard, the aim of the study was to assess the combined effect of copper and arginine nanoparticles on the productivity of broiler chickens.

2. Materials and Methods

In the study, we used copper nanoparticles (NPs) with a size of d = 90 ± 5 nm (the particles were a crystalline copper core with a CuO oxide shell on the surface). Nanoparticles were obtained by high-temperature condensation on a MiGen facility (Institute of Energy Problems of Chemical Physics, Russian Academy of Sciences, Moscow). Material certification of preparations included scanning electron and transmission microscopy using JSM 7401F and JEM-2000FX (JEOL, Japan), X-ray phase analysis with a DRON-7 diffractometer (NPP Burevestnik, Russia), atomic force microscopy with a multi-microscope SMM- 2000 (JSC PROTON-MIET, Russia).

Arginine hydrochloride (Tianjin Tiyanyan Pharmaceutical Co., Ltd, China) was used as the amino acid preparation.

The experiment was carried out on Smena 8 cross chickens. For the experiment, 11-day chickens (n = 90) were selected, they were divided into 3 groups using the analog pair method (n = 30 each). At the age of 15 days, birds from groups II and III were introduced into the main diet (RR) daily with copper nanoparticles at a dose of 4 mg/kg of feed (Sawosz et al., 2018). For poultry in group III, starting from 15 days of age, arginine was added daily to the main diet (RR) at a dose of 10 g/kg feed (Chamruspollert, Pesti & Bakalli, 2002). The chickens from group I received only the main diet.

The keeping of poultry and the procedures during the experiments complied with the requirements of the instructions and recommendations of the Russian regulations (Order of the Ministry of Health of the USSR[1] 755 of 08/12/1977) and "The Guide for Care and Use of Laboratory Animals (National Academy Press, Washington, D.C., 1996)". Formation of rations for the experimental poultry during the research was carried out taking into account the recommendations for feeding (Fisinin, Egorov, Draganov, 2011). Feeding was carried out twice a day; the feed intake was monitored daily. Drinking was ad libitum. The growth and development of chicks was assessed (examination and individual weighing). Poultry decapitation under nembutal ether was at the age of 42 days.

Blood samples for hematological studies were taken in vacuum tubes with an anticoagulant (EDTA-K3) and for biochemical studies - in vacuum tubes with a coagulation activator (thrombin). Determination of blood hematological parameters (erythrocytes (RBC), hemoglobin concentration (HGB), hematocrit (HCT), leukocytes (WBC), lymphocytes (LYM), monocytes (MON), granulocytes (GRA)) was performed using an automatic hematological blood analyzer URIT 2900 VET Plus (manufacturer - URIT MEDICAL ELECTRONIC CO., LTD, China). Biochemical parameters (total protein (TP)) of blood were determined using an automatic biochemical analyzer CS-T240 (manufactured by Dirui Industrial Co., Ltd., China).

The concentration of NO-metabolites (NO) (total amount of nitrate and nitrite ions) in blood plasma was determined spectrophotometrically with the Griss reagent on an Infinite PROF200 microplate analyzer (Tecan Austria GmbH, Austria) at λ= 540 nm. Whole blood was previously deproteinized by adding a 2-fold excess of 96% ethyl alcohol to 1 ml. Since the method allows determining only nitrite ions, vanadium (III) chloride was added to the plasma to reduce nitrates to nitrites, after that tubes were placed in a water bath (37 °C, 30 min). The results obtained after measuring of the optical density of the samples were compared with the calibration curve. To construct it, a series of dilutions of a NaNO2 solution (from 5 to 100 μM) was prepared and the samples were processed similarly to the

experimental samples (21). NO-metabolites were also determined in tissue samples. In this case, sample preparation included processing the biomaterial in a phosphate buffer solution (pH 7.45) with a TissueLyser LT homogenizer (Qiagen N.V., Germany).

Studying the amino acid composition of poultry tissues and feed, the mass fraction of arginine, lysine, methionine, tyrosine, phenylalanine, histidine, leucine-isoleucine, valine, proline, threonine, serine, alanine, and glycine was taken into account. Preparing liver tissue and food samples, the material was homogenized (TissueLyser LT, Qiagen N.V., Germany), dried at 60-70 ° C and powdered. The samples under study were subjected to acidic or alkaline (only for the determination of tryptophan) hydrolysis at a temperature of 110 °C for 14-16 hours. After acid hydrolysis, the samples were filtered (ash-free slow filtering filters "blue ribbon", LLC "MELIOR XXI", Russia); no filtration was performed after alkaline hydrolysis. The hydrolysates were mixed with reagents (sodium carbonate, Bashkir Soda Company JSC, Russia; phenylisothiocyanate, Shandong Hailan Chemical Industry Co., Ltd, China) and evaporated in a stream of warm air. The dry residue was diluted in distilled water (0.5 ml) and centrifuged (5 min, 5000 rpm). The resulting supernatant was studied by capillary electrophoresis using the Kapel system (OOO Lumex-Marketing, Russia; GOST 55569-2013). Data are presented as an arithmetic mean (M) with standard error of the mean (m). Statistical analysis was performed using ANOVA techniques (Statistica 10.0 software package, StatSoft Inc., USA). Differences were considered statistically significant at $P \leq 0.05$ using Student's t test.

3. Results

The introduction of copper NPs into the diet was accompanied by an increase in the live weight of poultry of the II group in comparison with the control by 3.9% on the 3rd day of the experiment, by 6 ($P \leq 0.05$)% after 15 days and by 6.6% ($P \leq 0.05$) upon completion of the study (Figure 1).

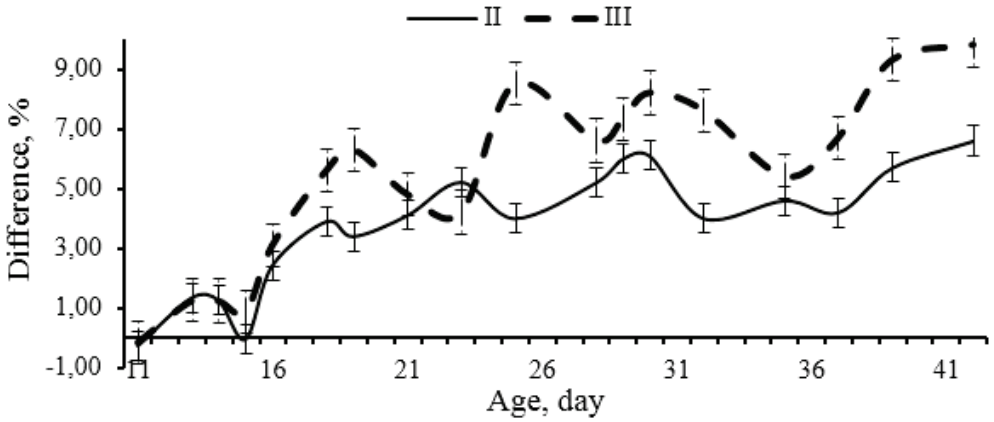

Figure 1 Dynamics of difference in live weight of chickens of II and III groups in comparison with control

The combined use of copper nitrate and additional amounts of arginine in the main diet of group III led to an increase in the live weight of the experimental poultry by 5.6 ($P \leq 0.05$)% after 3 days, by 7.32% after 2 weeks of the study and by 9.8 ($P \leq 0.05$) at the end of the experiment.

Analysis of the morphological parameters of blood revealed an increase in the number of erythrocytes and hemoglobin in the second group by 10 and 5.48 ($P \leq 0.05$)% in comparison with control values, in the third by 10.7 and 4.79 ($P \leq 0.05$) % respectively. The change in the number of red blood cells found a natural expression in an increase in hematocrit by 4.1 and 3.7% in groups II and III, respectively (Figure 2).

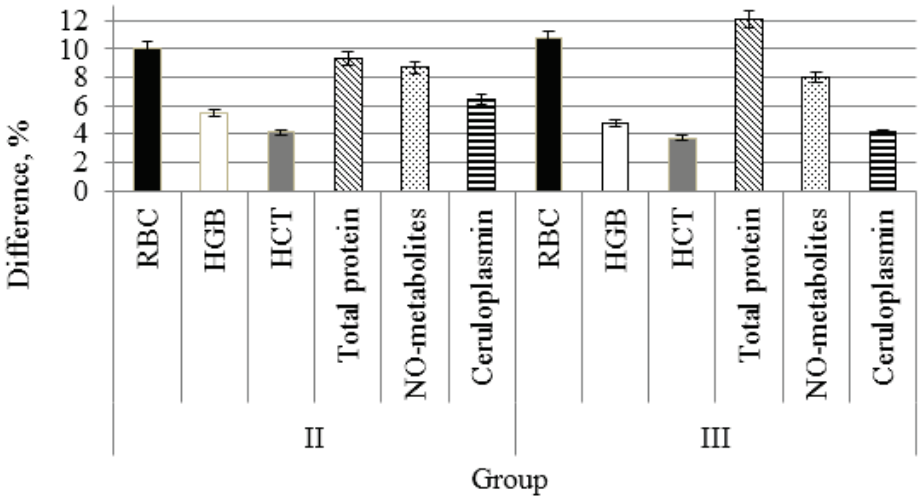

Figure 2 The difference (%) with the control (group I) in morphological and biochemical parameters of the blood of birds of group II and III

The study of level of total protein and NO-metabolites in blood serum showed an increase in indicators in the second group by 9.27 and 8.66 ($P \leq 0.05$)%, in the third by 12 and 8.01 ($P \leq 0.05$)% compared to control values. The concentration of ceruloplasmin was increased in the second and third groups by 6.41 and 4.1 ($P \leq 0.05$)%, respectively.

Among white blood cells, there was an increase in monocytes by 4 and 2.7 ($P \leq 0.05$)% in comparison with the control (Table 1).

Table 1 The content of white cells in blood of broiler chickens (age - 42 days)

Parameter	Group			
	Experience start	I	II	III
Leukocytes, 10^9/л	19,6±0,45	19,3±0,25	19,6±0,24	19,4±0,31
Lymphocytes, 10^9/л	10,5±0,55	9,88±0,29	9,96±0,45	9,92±0,37
Monocytes, 10^9/л	1,48±0,11	1,49±0,04	1,55±0,02*	1,53±0,03*
Granulocytes, 10^9/л	7,68±0,2	7,97±0,09	8,1±0,31	7,96±0,25

* Differences with control are significant at $P \leq 0.05$.

The amino acid composition of the liver changed only in group II and was significantly increased in comparison with the control by 3.6 ($P \leq 0.05$)% at the end of the study (Figure 3a).

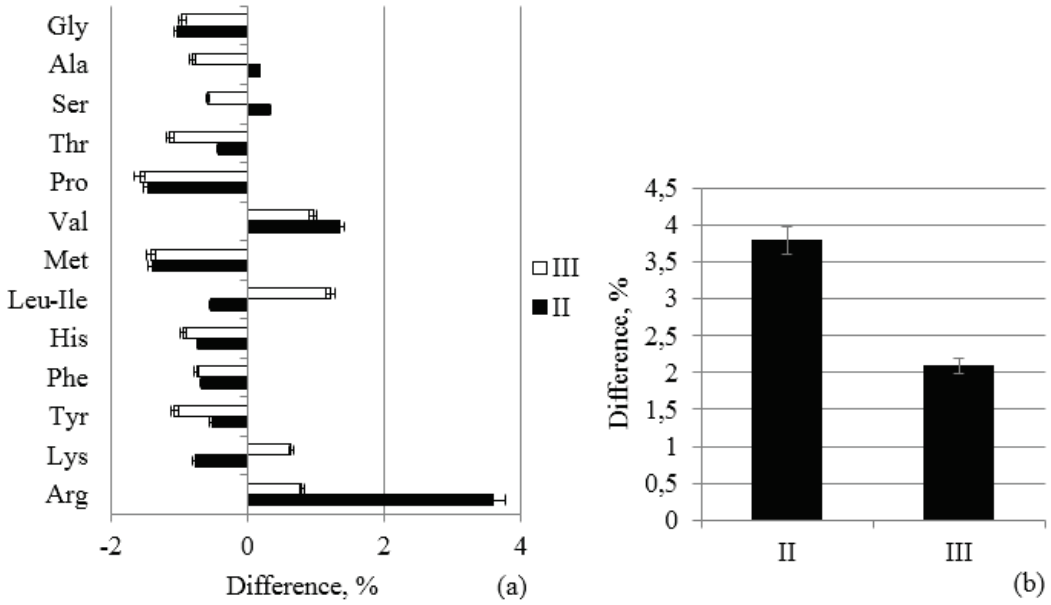

Figure 3 The difference (%) with the control (group I) in amino acid composition (a) and the level of NO-metabolites (b) in liver of broilers of groups II and III

Changes in the level of NO-metabolites in poultry liver were observed in both experimental groups. The content of NO-metabolites in liver of poultry of group II was increased by 3.8 ($P \leq 0.05$)%, in group III by 2.1% (Figure 3b).

4. Discussion

Copper nanoparticles showed a pronounced growth-stimulating effect throughout the experiment. A similar effect of copper preparations has been shown in a number of works by other researchers and confirms the results obtained (Scott et al., 2017; Sharif, Rahman, Ahmed, Abbas & Hassan, 2020). However, the combined use of arginine and copper nanoparticles was 3-4% more effective than their separate use.

The effect of copper nanoparticles on poultry productivity was probably due to their effect on a number of physiological parameters. An increase in the level of leukocytes, in particular monocytes, and the concentration of ceruloplasmin was registered. Ceruloplasmin is a ferroxidase that plays a role in iron homeostasis and antioxidant defense of the body, and can indirectly affect the production of nitric oxide (Lazzaro et al., 2014). We observed an increase in the concentration of NO-metabolites both in the blood serum and in the liver of the experimental bird. An increase in these parameters was probably a prerequisite for a change in

the level of arginine in liver. A number of works note that arginine synthesis can be initiated in several ways, including through the synthesis of nitric oxide, and is also associated with the development of oxidative and inflammatory stress (Xiao et al., 2017; McKell et al., 2021). An arginine increase in liver combined with an increase in total serum protein showed a close relationship with an increase in the live weight of the experimental bird. This was consistent with data on body weight increase by up to 5 grams with the deposition of one gram of protein in the body (Miroshnikov, 2008).

The addition of an additional amount of arginine to the diet with copper nanoparticles contributed to a decrease in the level of arginine synthesis in liver, which was accompanied by a decrease in the amount of NO-metabolites in the liver. However, an increase in the level of monocytes and NO-metabolites was noted in blood. This is due to the fact that arginine itself was a source of NO-metabolites. NO was formed due to the oxidation of one of the terminal nitrogen atoms in the guanidine group of L-arginine (Xiao et al., 2017). This determined a close relationship between NO production and arginine intake. The formation of physiological levels of nitric oxide from arginine has an indirect positive effect on animal performance (Che, Adams, Zhao, Qin & Jiang, 2019).

In addition to the above changes in the experimental groups, there was an increase in the level of erythrocytes and hemoglobin, which was most likely due to the action of copper nanoparticles (El-Kazaz SE & Hafez, 2019; Vishnyakov, Udavliev, Timofeev & Kvan, 2020). Arginine could also have an indirect effect on these indicators. It is known that an increase in the concentration of L-arginine leads to the stimulation of the secretion of growth hormone in the body and is capable of causing vasodilation (Yi et al., 2009).

As a result, the combination of these effects of nanoparticles and arginine determined the greater efficiency of their combined use. The experimental data showed the prospects for using a combination of copper and arginine nanoparticles in the nutrition of poultry and are the basis for the further development of an organomineral supplement.

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International Marketing Approaches for Biofertilizer Products: A Case of Rolling Greens Company in Taiwan

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Abstract

Rolling Greens is a Taiwan-based company which develops and manufactures environmentally friendly fertilizers (biofertilizers). It is expanding its markets to various countries, which one of them is Indonesia. This study aims to describe Indonesian agriculture and its potential market for soil microbe product, produced by Rolling Greens Co., Ltd. The study includes the literature review of country's geographical (climate and land) condition, agriculture sector (crops, workforce, production, and input products), and market potentials for biofertilizer. The study concludes that Indonesia is a good potential big market for Rolling Greens. Horticulture farmers in Java are seems to be a good target and work together with distributor is highly suggested. In this paper, there are proposed three ways to do marketing for biofertilizer product in Indonesia, which are direct selling, through distributor, through B2B and B2C business model. Moreover, the company should be competitive in the product quality and price.

Keywords: *International marketing; Biofertilizer; Taiwan; Indonesia*

1. Introduction

The sustainability issue has drawn the attention and lead to the development and the usage of 'eco-friendly' input in agriculture such as fertilizer, soil amendment product, pesticide, etc.. Soil microbe product (known as biofertilizer) is also popular as it has the functions as the supply of nutrients, producing a substance in promoting plant growth, pest control, and active in biodegradation and bioremediation. It has been developed and marketed by research institutes and privates in recent years.

Rolling Greens is a Taiwan-based company that develop and manufacture environmental friendly fertilizers. Rolling Greens' goal is to achieve agricultural sustainability and help improving growers' living standard, where the growers can produce more with less.

This company is expanding the market, especially in neighbor countries. Indonesia is one of them. The distance between Taiwan and Indonesia is not far. Moreover, Indonesia is developing country which means open to innovations. The country is big, the population is high, and is friendly to Taiwan.

This paper aims to feature the potentials of Indonesian market for soil microbe product.

2. Indonesia Country Overview

Indonesia (Republic of Indonesia) is a country in the Southeast Asia, located between Asia and Australia. It is located in the equator, so the day lasts 12 hours throughout the year. It has a tropical climate, which means it is hot, humid and rainy throughout the year. There are only two seasons, dry season (April until September) and rainy season (October until March). The temperature is stable, with lows around 22/25°C and highs around 30/32°C all year round. The main difference of the area is found in the rainfall, which quantity and distribution are due to the location in a hot and humid area, but also due to the monsoon regime and the impact that it has on the different areas.

The country is the 14th largest country by land area (1,904,569 square kilometres). Indonesian archipelago, which consists of 17,508 officially listed islands, makes Indonesia the world's largest island country. As seen in Picture 2, the country is divided into 34 provinces, in 7 major islands: 1) Sumatra; 2) Kalimantan (part of Borneo); 3) Sulawesi; 4) Moluccas; 5) West New Guinea, 6) Java; and 7) Bali and Nusa. There are more than 260 million people (per June 2020). In 2017, there are 36 million people work in agriculture (30% of the total workforce).

3. Indonesian Agriculture Sector

Indonesia is currently a developing country which being called newly industrialized country. It is the world's 16th largest by nominal GDP and the largest in Southeast Asia. It is also being said as one of the emerging market economies of the world.

Agriculture is one of the key sectors as 30% land area is for agriculture. It produces a lot of kinds of tropical products. Due to the differences of geographical conditions, natural resources, and native culture, the agricultural commodities in each island may differ as seen in Figure 1. Effective and efficient logistic system is a major challenge in its agricultural supply chain.

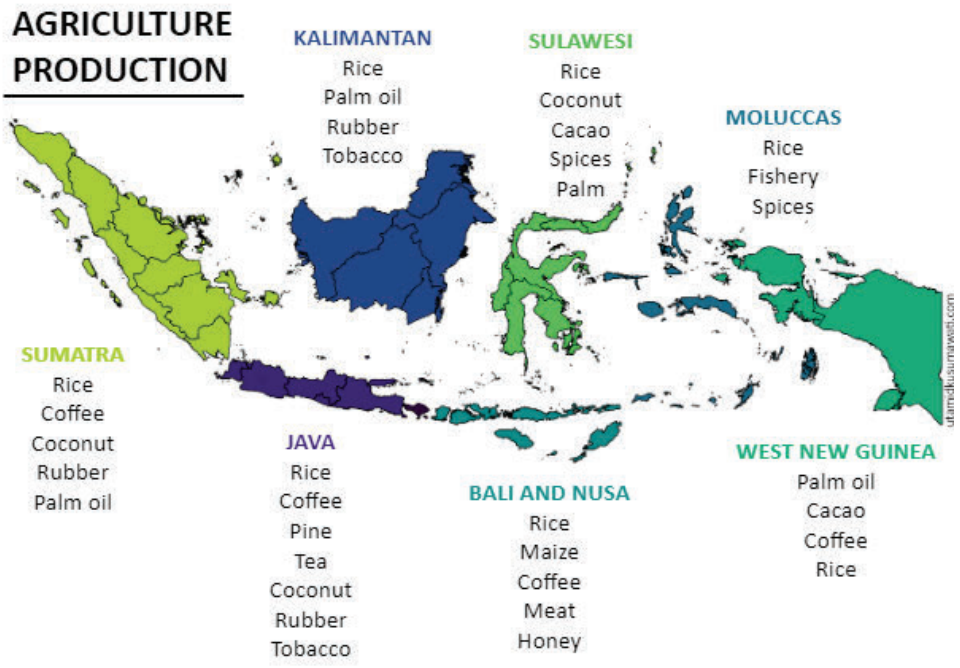

Figure 1 The agricultural commodities production areas in Indonesia

On developing its the agriculture industry to achieve national food security, Indonesian government through its Ministry of Agriculture, set the focus to reach self-sufficiency especially for these seven commodities: 1) Rice; 2) Maize; 3) Soybean; 4) Beef; 5) Sugarcane; 6) Chilli; and 7) Shallot. In addition to sugarcane, for plantation commodities there are six more commodities: 1) Cocoa; 2) Rubber; 3) Coffee; 4) Coconut; 5) Palm; 6) Spices (pepper, nutmeg, and clove). Table 1, Table 2, Table 3, and Table 4 show the production of the food, horticulture, and plantation commodities.

Table 1 Production of three main food commodities in 2014-2018 (tons)

Commodity	Year					Top production area in 2018
	2014	2015	2016	2017	2018	
Rice	70,846,465	75,397,841	79,354,767	81,148,594	83,037,150	East Java, West Java, and Central Java
Maize	19,008,426	19,612,435	23,578,413	28,924,015	30,055,623	East Java, West Java, Lampung, and South Sulawesi
Soybean	954,997	963,183	859,653	538,728	982,598	East Java, West Java, and Central Java

Source: Indonesian Ministry of Agriculture website

Table 2 Production of three main horticulture commodities in 2014-2018 (tons)

Commodity	Year					Top production area in 2019
	2015	2016	2017	2018	2019	
Chilli pepper	1,045,182	1,045,587	1,206,266	1,206,737	1,214,419	West Java, Central Java, North Sumatra, and West Sumatra
Bird’s eye chilli	869,938	915,988	1,153,155	1,335,595	1,374,217	East Java, West Nusa Tenggara, Central Java, and West Java
Shallots	1,229,184	1,446,860	1,470,155	1,503,436	1,580,247	East Java and Central Java

Source: Indonesian Ministry of Agriculture website

Table 3 Production of sugarcane in 2016-2020 (tons)

Commodity	Year					Top production area in 2019
	2016	2017	2018	2019	2020	
Sugarcane	2,204,619	2,121,671	2,170,948	2,258,133	2,416,846	East Java and Lampung

Source: Indonesian Ministry of Agriculture website

Table 4 Production of horticulture commodities in 2015-2019 (tons)

No.	Commodity	Year				
		2015	2016	2017	2018	2019
1	Shallots	1,229,184	1,446,860	1,470,155	1,503,436	1,580,243
2	Garlic	20,295	21,150	19,510	39,300	88,817
3	Spring onion	542,486	537,921	510,476	573,216	590,596
4	Potato	1,219,270	1,213,038	1,164,738	1,284,760	1,314,654
5	Cabbage	1,443,232	1,513,315	1,442,624	1,407,930	1,413,059
6	Cauliflower	118,388	142,844	152,869	152,114	183,815
7	Mustard	600,188	601,198	627,598	635,982	652,723
8	Carrot	522,520	537,521	537,341	609,630	674,633
9	Radish	21,475	19,478	22,417	27,236	24,247
10	Red beans	42,384	37,165	74,364	67,862	61,517
11	Long beans	395,514	388,056	381,185	370,190	352,695
12	Chilli pepper	1,045,182	1,045,587	1,206,266	1,206,737	1,214,418
13	Bird’s eye chilli	869,938	915,988	1,153,155	1,335,595	1,374,215
14	Bellpepper	5,655	5,254	7,390	18,151	19,357
15	Mushroom	3,348,464	40,914	37,020	31,052	33,163
16	Tomato	877,792	883,233	962,845	976,772	1,020,331
17	Eggplant	514,320	509,727	535,419	551,529	575,392
18	Green beans	291,314	275,509	279,040	304,431	299,310
19	Cucumber	447,677	430,201	424,917	433,923	435,973
20	Chayote	431,203	603,314	566,845	453,989	407,962
21	Watercress	305,071	297,112	276,970	289,555	295,556
22	Spinach	150,085	160,247	148,289	162,263	160,306

Source: Indonesian Ministry of Agriculture website

4. Indonesian Agriculture Market Potentials for Biofertilizer

Prihastuti (2016) stated that there is a demand from the market for a product which consists of more microbes so the product can meet the four functions of soil microbe, which are promoting plant growth, pest control, and active in biodegradation and bioremediation. With deeper understanding about the microbe’s characteristics, such product is possible to be developed.

The selling point of soil microbe product or biofertilizer is lying on to its ability to increase plant productivity. Therefore, as it supports the government program on achieving self-sufficiency and environmental conservation, soil microbe product has a good market

prospect.

For the marketing, there are four common ways to sell the biofertilizer in Indonesia, which are:

1. Direct selling to the user through sales agents
   This is a very common way for company to sell their product directly to the farmers. The sales agents visit and talk directly to the farmers in the field or farmers' meeting or house.
2. Through distributor/sub distributor
   The company can also cooperate with distributor or sub distributor in Indonesia such as *koperasi* (cooperation), farmers' association, stores, etc.. The distributor or sub distributor will put the product in their places and sell it to the farmers. In some cases, the farmers will ask for their recommendation about which product has good quality.
3. Through distributor channel (company) and through internet (E-Commerce)
   In the case of foreign company, Business to Business (B2B) business model can be done through cooperation with local company. By the help of local company, the product can be marketed more suitable for local condition. For example, knowing what factors the farmers consider while choosing a fertilizer, local wisdoms, farmers' value and habit, etc. Other way, Business to Consumer (B2C) business model can be done through internet by the use of E-Commerce. The consumer (C) in this business model is the farmers.

A study done by Aprianti et al (2015) showed that there are three main attributes that are important for users on choosing biofertilizer. The attributes are quality, price, and product ingredients. Other attributes which also being considered are brand, easiness to use, availability, attractive advertisement attributes, and price discount. Prihastuti (2016) stated that product quality is the main attribute to be concerned so the product potentially has a captive market.

5. Conclusion

Indonesia is a good potential big market for Rolling Greens. Horticulture farmers in Java are seems to be a good target and work together with distributor is highly suggested. In this paper, there are proposed three ways to do marketing for biofertilizer product in Indonesia, which are direct selling, through distributor, through B2B and B2C business model. It is suggested for the company to be competitive in the product quality and price. This paper can be an example on doing international marketing.

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Internet of Things Communication Protocols for Digital Twins in Dairy Barns: Communication Scheme and Feasibility Study

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Abstract

As the world's population grows and climate protection requirements increase, the demands on the agricultural industry are coming to a head. The agricultural industry must grow to meet the demand for food, but at the same time consider emissions of climate-relevant gases and animal welfare. Combining these requirements demands new efficient technologies that can show the farmer optimization potentials and implement them autonomously.

This paper presents a applicable Internet of Things communication scheme to link sensors, actuators, and (predictive) models to form a digital twin. The digital twin is a virtual representation of the physical twin or the real world, with bidirectional communication in between. With data flowing from the physical twin to the virtual image, predictions can be made, or optimizations performed. If the resulting commands for the actuators are sent back to the physical twin, the optimization potential can be exploited automatically.

The conducted feasibility study shows how the communication scheme can be implemented. Different operating systems, sensors and software programs were networked, and the communication was tested. The data was visualized in a web app that can be made available locally (intranet) or globally (internet). When used in a free-ventilated dairy barn, the digital twin could react promptly to changes in the weather, e. g., to ensure animal welfare and low emissions.

Keywords: *Digital Twin, Internet of Things, Communication Scheme, Dairy Barn*

1. Introduction

Climate change is associated with an increasing number of extreme weather events (Mann et al., 2017), which confronts the agricultural industry with the challenge of adapting to constantly changing conditions. In addition, as the global population increases to 9.66 billion by 2050 (United Nations, 2019), more food capacity will need to be built. Akhigbe et al. (2021) describe how the agricultural industry can address these challenges using Internet of Things (IoT) technologies. The digital twin is one of the main concepts in the context of IoT (Negri et al., 2017). The goal of the digital twin is to have a virtual representation of the real-world application. In this way, the assets state can be monitored in real-time, and one can intervene in a timely manner. With appropriate simulation models, it is also possible to predict the systems response and how the system will evolve under the prevailing conditions. Ideal settings can be derived from the predictions and implemented back in the system using real time communications schemes between digital twin and real twin. This means that continuous communication is required for implementation, which can integrate all sensors, actuators, and software modules. For ergonomic human-machine interaction, it is necessary to visualize the system status for the farmer: e.g., to retrieve the temperature humidity index (THI) calculated in real time and adjust the ventilation conditions accordingly.

2. Related Research

Many research has been done concerning hardware, communications concepts, or data processing for digital twins. Table 1 lists the various papers analyzed. Depending on the purpose, different software modules are generally used for user interaction. More specific details of the different data formats are addressed only by Jung et al. (2018), Lee et al. (2018), and Moshrefzadeh et al. (2020). To the best knowledge of the authors a solution for the user interface (UI) for different common devices still remains open to date. Hence the scope of this paper is to develop an integrative solution that could be applicable for diverse devices and run both in a cloud and locally.

Table 1 Related research with ranked scope

Shortened Title	Physical Entities	Communication Scheme	Compute Data	User Interface (UI)	Data Structure/ Format	Agricultural industry	Reference
Digital Twin Conceptual Model	•	•	•		•		(Al-Ali et al., 2020)
A digital twin for smart farming	•	•	•	•		•	(Alves et al., 2019 - 2019)
Decision Support System	•	•	•	•		•	(Ghandar et al., 2021)
Smart Livestock Farms Using DT	•		•			•	(Jo et al., 2018 - 2018)
Dynamic Co-Simulation		•	•		•		(Jung et al., 2018)
Implementation of CPPS	•	•	•	•	•		(Lee et al., 2018)
Towards a Distributed Digital Twin	•	•			•	•	(Moshrefzadeh et al., 2020)
AgriLoRa: A DT Framework		•	•			•	(Angin et al., 2020)
Digital twins in smart farming	•	•	•	•		•	(Verdouw et al., 2021)

3. Communication Scheme

3.1 Communication Participants

Essential communication participants in free-ventilated dairy barns comprise the sensors and actuators relevant for animal welfare and air exchange. For evaluation of animal welfare, the temperature-humidity index (THI) can be calculated (Berry et al., 1964), for which temperature and humidity sensors must be placed inside the barn. To control air exchange or air circulation in the barn, fans or roll-up ventilation must be actuated.

To process any measured values and implement simulation models or prediction algorithms, necessary software programs or algorithms must also be able to participate in the communication. In addition to traditional simulation software, control engineering or modeling, algorithms with artificial intelligence can also be considered.

The status of the sensors, actuators and software programs must be visualized and made available to the farmer. For the farmer to be able to call up the status while working in or outside the barn, the communication scheme must be accessible for different common devices including computers, smartphones, and tablets.

The named communication participants result in a hierarchical structure shown in Figure 1, based on Deutsches Institut für Normung e. V. (2014).

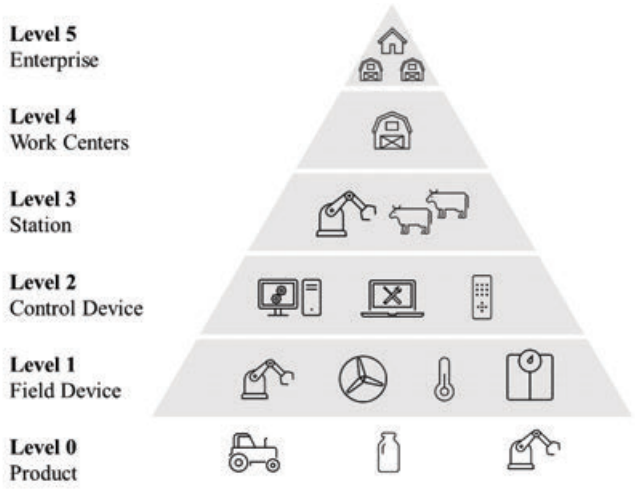

Figure 1 Classification of communication participants in a hierarchical structure according to Deutsches Institut für Normung e. V., (2014)

3.2 Communication Interface Requirements and Selection

For real-time calculation of the THI, the sensor values of air temperature and humidity must be provided and retrieved a communication protocol. The sensors in the dairy barn are usually inaccessible for cable-guided communication. The requirement for wireless communication in turn entails that the interface must be equipped with appropriate security concepts in communication.

Jung et al. (2018) investigated different interfaces suitable for co-simulation with IoT components. Functional Mock-Up Interface (FMI), High Level Architecture (HLA), Open Platform Communication Unified Architecture (OPC UA) and Open-Services-Gateway initiative (OSGi) were investigated regarding their suitability. Only OPC UA and OSGi allow new models or communication participants to enter and exit during runtime. The communication of the OPC UA interface runs via TCP IP and can be provided with encryption if required. In addition, the Industrie 4.0 reference architecture model recommends the OPC UA interface for levels 1 to 4 shown in Figure 1 (Deutsches Institut für Normung e. V., 2018).

For access to the data of hierarchy level 5 (Figure 1), there is currently no recommendation from Deutsches Institut für Normung e. V. (2018). Lee et al. (2018) has provided a solution for the communication of a digital twin in metal casting using OPC UA (levels 1 to 4) and Representational State Transfer (REST) (level 5). However, their approach uses a stand-alone software solution for the dashboard. Since this requires a separate software solution for each device makes it difficult to manage the system centrally and uniformly for all end devices.

The approach of this paper is to implement both the communication of level 1 to 4 via

OPC UA and level 5 via Rest in a browser-based web app (Figure 2). In this way, the dashboard is managed centrally, and access is enabled from all devices supporting browsers. The web app can be hosted locally from a server or globally on the Internet. This enables cloud concepts and local solutions without deviating from the communication scheme.

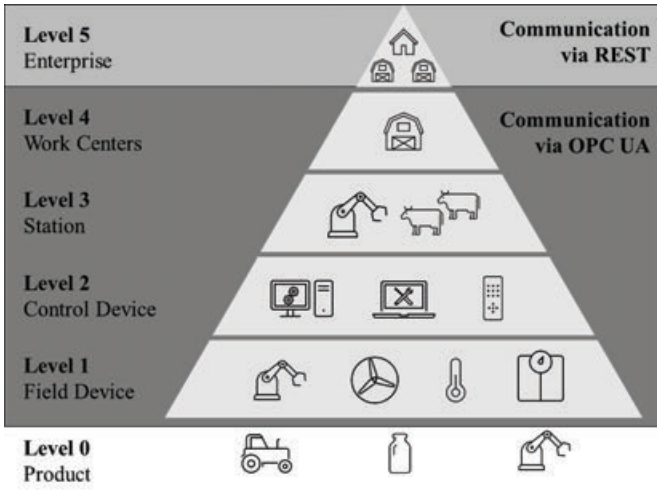

Figure 2 Classification of the communication protocols for the hierarchy levels

3.3 Communication Flow and Scheme

Based on the preliminary considerations of chapter 3 a communication scheme was developed that includes data flow and storage (Figure 3). The communication scheme is composed as follows.

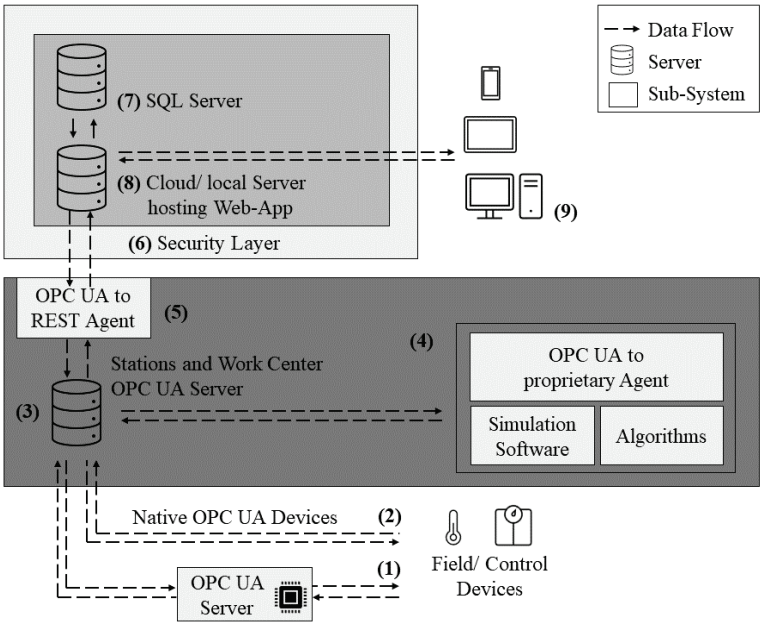

Figure 3 Developed communication scheme for the digital twin in dairy barns, (1) to (9) indicates the essential communication steps and components

(1) Communication with nonnative OPC UA field and control devices: in case the device has no OPC UA functionality, a microcontroller can translate the native data to an OPC UA server structure.
(2) Native OPC UA field and control devices: the collected data can directly be transferred to the OPC UA Server for stations and work center.
(3) Stations and work center OPC UA server: with OPC UA folder organization the server can be used for stations and work center.
(4) Distributing data to analyzing or simulation software: commercial software or self-written algorithms can be connected directly or by means of data conversion (in case of nonnative OPC UA functionality).
(5) Translating agent: to convert OPC UA data and send it via REST to the local or cloud server.
(6) Security layer: for restricted access and security the external server communication must be encrypted and authorized by accounting.
(7) SQL server: for historical sensor and actor data access the relevant data must be stored, as well as the structure of digital twins.
(8) Server for hosting Web-App: to provide the web app, the server must host it for both local and global access
(9) Access via end devices: the hosted web app is available for devices with a browser

3.4 Data Formats

The communication scheme requires a translation between the communication via OPC UA and REST. The JavaScript Object Notation (JSON) data format was used here to transfer the data. This data format is not subject to a generally valid structure but carries it with it. It is referred to as a semi-structured data format (Al-Ali et al., 2020). The advantage of the JSON format is that the data can thus not only be translated, but also transported and provided via REST command. The description of the digital twins was thus consistently created in JSON format, following the Digital Twin Definition Language of Microsoft Azure (Prashmo, 2021).

4. Feasibility Study

A feasibility study was conducted to determine whether the communication scheme developed could be implemented. For this purpose, sensors for measuring temperature and humidity were selected and connected to an OPC UA server using the communication scheme. The THI was calculated with the help of software. Finally, a software library was chosen to program a web-app to visualize the results on diverse devices via cloud server.

4.1 System Hardware

Two Bosch BME 280 devices with I²C bus connection were used as sensors (Figure 4 a)). The sensors provide values for temperature, humidity, and air pressure. The measurement accuracies are specified for the temperature with max. ± 1.5 °C, the relative humidity with ± 3 % and the air pressure with ± 1.5 Pa/ °C (Bosch Sensortec, 2021).

To provide the sensor data, the values were retrieved from a Raspberry Pi Zero W microcontroller (Figure 4 b)). The microcontroller has a single-core 1 GHz CPU and 512 MB RAM (Raspberry Pi Foundation, 2021). The maximum power consumption was 2.5 W.

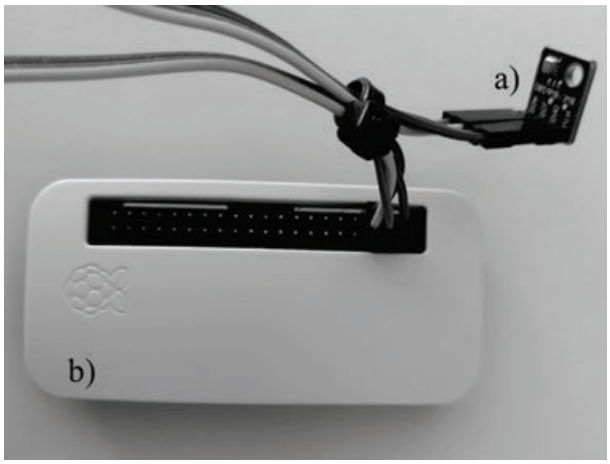

Figure 4 a) Bosch BME 280 sensor with I²C Bus connected to a Raspberry Pi Zero W b)

The central OPC UA server (Figure 3, (3)) was hosted by a PC. The PC is equipped with an Intel Core i7-9700K (8 cores @3.6 GHz). The RAM is 64 GB DDR4. The graphics card is an Nvidia RTX 2070.

A cloud server was used to deploy the web app, which is limited to 512 MB of memory and 100 s of CPU usage per day. Bandwidth is specified as non-prioritized or reduced for the model used. (PythonAnywhere, 2021)

4.2 System Software

A console version of Raspbian was installed on the Raspberry Pi Zero W (Figure 3, (1)). Using a Python script, the sensor data of the BME 280 could be retrieved via the I²C bus. The software library opcua-asyncio (licensed via LGPL-3.0 License) was installed and integrated into the script to make the sensor data available on an OPC UA server on the Raspberry Pi. The Work-Center OPC UA Server was also built with this library (Figure 3, (3)). The commercial software Matlab (R2019a) was used as an example of simulation software (Figure 3, (4)) to calculate the THI in real time based on the sensor data. The transmission of the data via REST (Figure 3, (5)), was also done using a Python script. In order to secure the request (Figure 3, (6)), a JSON web token must be added to the request, which is compared with the

token stored for the user on the SQL server (Figure 3, (7)). The SQL server is built with the relational database management software MySQL and stores hashed passwords, user data, sensor data or the description of the digital twins. The web app hosted on the cloud server has been programmed with the software library flask (licensed via BSD 3 clause license). The library enables the management of web server and web app communication. In addition, the security of access can be managed via the Flask-Security sub-library.

5. Results

This chapter will document the results of the most important stages of the feasibility study. Starting with the sensor (chapter 5.1), through the simulation software (chapter 5.2), to the web app (chapter 5.3).

5.1 Sensor

Figure 5 shows the console of the Raspberry Pi Zero W during the runtime of the python script that reads out the sensor values and provides them via OPC UA. The OPC UA node and sensor value are given out in each case.

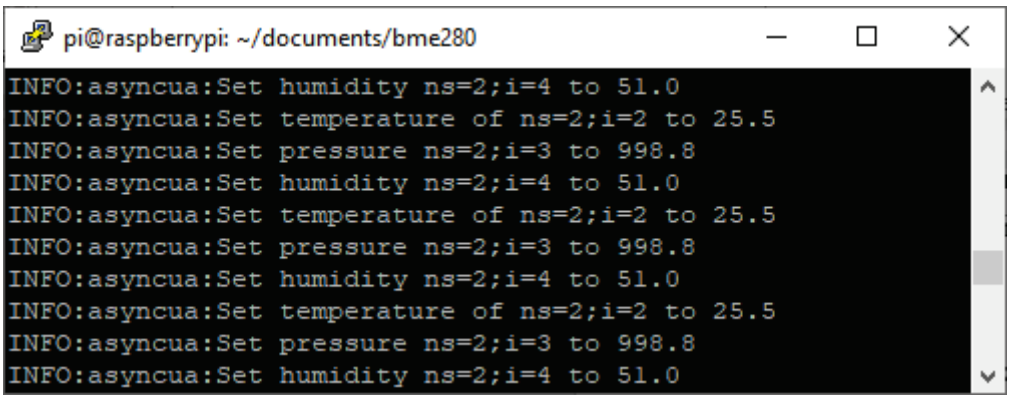

Figure 5 Raspberry Pi console during runtime of the python script accessed via PuTTY

5.2 Simulation Software

In Figure 6 the console output and the values previously retrieved by means of script in the workspace can be seen. In the console window, the calculated THI based on sensor data is given out continuously, with a set pause of 0.5 s.

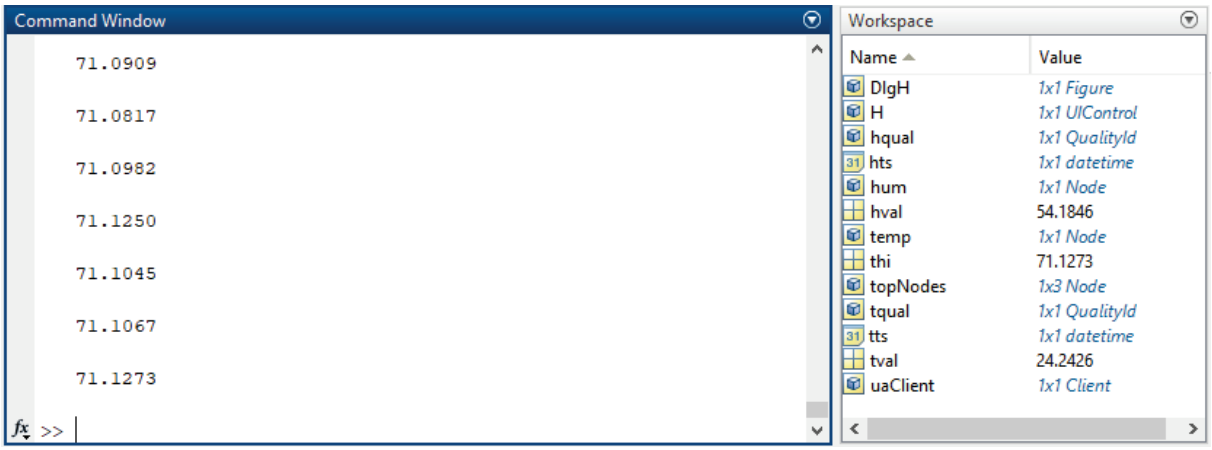

Figure 6 Command Window and Workspace for THI calculation in Matlab R2019a

5.3 Web App

The web app is divided into different tabs, with the essential functionalities (Figure 7):

- Database: here, digital twins already stored in the database can be called up, which can then be viewed and edited in the remaining tabs
- Dashboard: the dashboard shown in Figure 7 visualizes on the one hand the structure of the currently loaded twin and on the other hand the current sensor values
- Historical Data: select certain data and a sensor for which a graph will be generated
- Connection: this tab makes it possible to create a JSON Web Token for API access
- Manage Twin: store new twins in the Digital Twin Definition Language

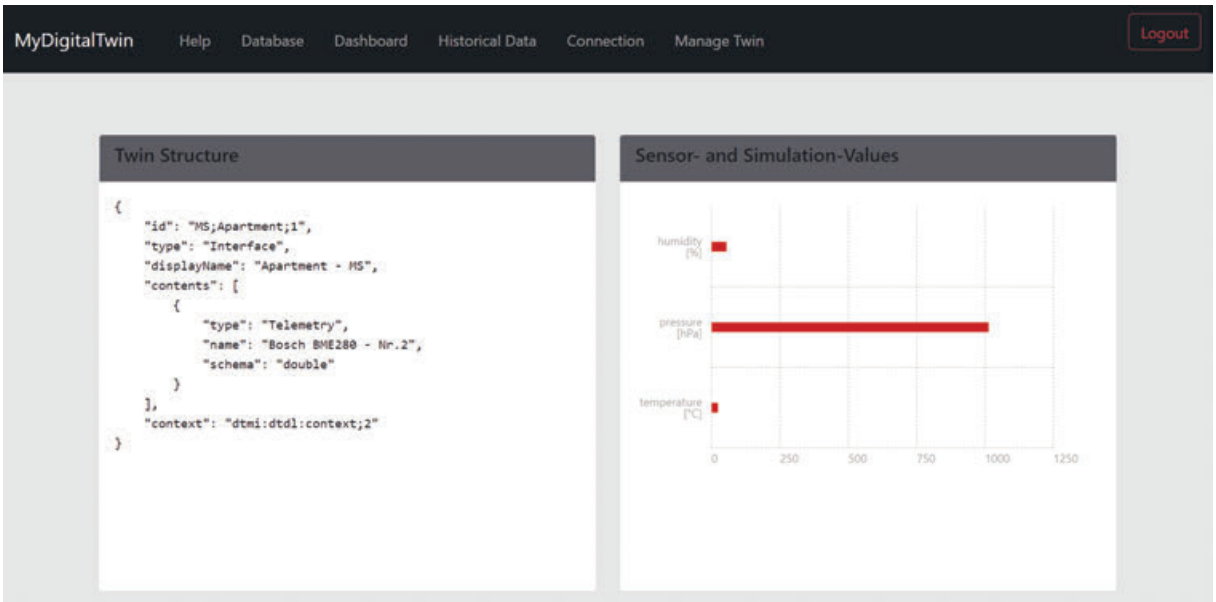

Figure 7 Web app hosted by a cloud server and programmed via flask

6. Conclusion

Within the scope of the study, an end-to-end communication for the digital twin could be

established using the IoT communication protocols OPC UA and REST. Different hardware and software can be considered in the communication scheme. The central management of the software for all end devices is possible using a web app both locally and in the cloud. The connection of non-native OPC UA simulation software is still an open issue since a different corresponding interface must be written depending on the software.

Based on the results of this paper, a prediction model for the dairy barn climate will be developed and integrated as part of another research project.

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Innovation Capacity Enablers: Examining Small Farmers through Agricultural Innovation System Approach in Malaysia

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Abstract

Within the Agricultural Innovation System (AIS) perspective, small farmers' innovation capacity remains under explore and given less attention that it should. This article written in promoting and employing small farmers' innovation capability to develop a more inclusive AIS towards addressing the pressing needs of food safely, rural employment, livelihood, and environmental sustainability. This study is intended to understand innovation capacity enablers and attempted in discovering how small farmers integrated with the AIS and how beneficial are the institutions for fostering and channeling their innovation capacity in focusing issues pertaining to agricultural development.

Small Farmers in Malaysia dominated the agricultural sector and yet the small farmers communities far from being studied in context of innovation. Although the government through its agencies and university has done a lot in pushing innovative agricultural solutions, small farmers still could not adopt the changes due to their lack of capacity. Issues pertaining to income, space availability and manpower need to be tackled through enhancing capabilities among small farmers.

To that extent, future research in innovation and capacity enablers development in Malaysia may unfold the insight of current problem faced by small farmers toward innovative practice.

Keywords: *Small Farm, Innovation in Agricultural, Agricultural Innovation System and Innovation Capacity*

1. Introduction

Agriculture Industry has been long being the prominent sector in Malaysia that contribute to the national GDP. Department of Statistic Malaysia reported in 2020 Selected Agricultural Indicators that agricultural activities contribute RM101.5m or 7.1% of Malaysia GDP. Agricultural export increased from 114.5b in 2018 to RM115.5b in 2019 (0.9% increase) while import increased from RM98.3b in 2018 to RMRM98.5b in 2019 (0.2% increase). Malaysia trade balance indicated a surplus where the increment in trade balance rose by 4.1% from RM21.1b in 2018 to RM22b in 2019 giving the huge opportunity for agriculture participants in growth.

The Agriculture Industry in Malaysia being dominated by small farmers (Zainuddin, 2020) which were described as had facing low productivity and crops yield due to lack of manpower and capabilities (Department of Statistic Malaysia, 2020). In its reporting, Department of Statistic Malaysia indicated that manpower in small farm sector dropped from 1.57m in 2018 to 1.541m in 2019, which has contributed significantly to the low productivity level and crop's yield. Innovative interventions need to enhance growth as this industry sector, the small farmers, is one of the most important sectors in Malaysia thus its practices should be improving, develops, implements constantly and continuously (Zainuddin, 2020). Several initiatives were taken by public and private sector to assist in the industry growth through innovation measurements such in R&D, technology enhancement and capital financial assistance for farmers to adopt to overcome the issue which elaborated further in later section of this article.

The Agricultural Innovation System (AIS) eventually drawn to undertake approaches to better the farm practices. AIS is a network of organization and individuals focuses on bringing new product process and new form of organization into economic use, together with the institutions and policies maker that effect the behavior and performance (World Bank, 2016). This study eventually utilized this approached in examining the small farmers' innovation capacity as AIS perceived that agricultural innovation is needed to give connection between participants. public and private institutions which engaged in agricultural value chain. The system needed to ensure the development of better farm practices. The number of rural poor has persisted, despite successful attempts at various innovation approaches such as AIS approach (Bergek, 2010). This article derived from content analysis focused on understanding and analyzing how innovation capacity is built and how it relates to the capabilities and resources from the angle of AIS perspective which will contribute to the book of knowledge and further research.

Innovation Capacity (IC) is built through constant effort of practices, routines or process needs to mobilize, create, and reconfigure arrangement of resources and capabilities (Boly,

Morel, Assielou, & Camargoa, 2014). It should influence transformative activities, according to Boly, Morel, Assielou, & Camargoa (2014) capacity is having the right configuration of capabilities in sufficient amount to enable successfully innovate thus capabilities constitute the capacity. Szeto (2000) reinstated that innovation capacity was known as progressively and continually improving capabilities of resources of firm in discovering opportunities to engage in use product or process development. The capacity building capabilities was drawn by Boly, Morel, Assielou, & Camargoa (2014) and Wang & Ahmed (2007) on the following thought which will further describe in later section of discussion:

1. Innovation Capabilities
2. Adoptive Capabilities
3. Absorptive Capabilities

While there was many high-quality research on innovation and innovation capacity been carried out in the past, literature on innovation capacity enablers related to small farmer emerge untapped and unexplored comprehensively. Capacity to innovate as known to be factors that hugely influence innovation, this study was initiate to understand those capabilities that enables capacity to innovate focusing into small farmers' community, Content analysis is used to explore and evaluate current and past research referring to the topic. The problem occurs to this type of method used when the information gathered are not done by sampling and questioning. Establishing connection between literature research and studies not as easy task however it is a good sampling to evaluate the proposition. Such information should be obtained from few or multiple input originating through real time interviewing with ample timeframe to validate the findings. Consequently, the finding may unfold the insight of capabilities among small farmers in facing challenges to growth. In the next section, this article will briefly review literatures related to the issue specifically on the Small Farm, Innovation in Agriculture, Agricultural Innovation System, and Innovation Capacity.

2. Small Farm

Farmers display specific attribute and act different roles in their regions, and these activities not an equivalent in weight at different stages of economic process. Small farms were known as varied and very much assorted. Eastwood, Lipton, & Newell (2010) stated that majority of the literature found describe small farms supported the dimensions of their land or livestock holdings, a typical and logical cut-off size being but 2 ha (World Bank, 2003). Land quality and access to resources like water also are key differentiators of small farms. it's essential to confine the institutional and technical characteristics within the definition of small farm. Being small isn't only about the land or herd size, but also about varied access to

markets and natural resources and therefore the degree of commercialization (Braun & Mirzabaev, 2015).

Table 1 Small Farm Concept and criteria

Concepts	Measurements	Strengths	Deficiencies
1. Land holding (or herd) size	Size in hectares cultivated Number of livestock	Simple accounting of physical characteristics; Important for agrarian societies	Lack of economic valuation of farm enterprise (quality of land, location to markets, etc.); ownership issues neglected
2. Employment	Labor in small farms	Important for economy- wide considerations, and for livelihoods	Returns to labor (especially marginal returns) undefined; economics of multiple job-holdings missing
3. Income	Annual production and net returns	Integrates with GDP shares; identifies growth and innovation performance; a basis for poverty identification in the small farm economy	Highly variable; pricing own consumption of farm products; externalities not captured (eco-systems services)
4. Total economic value (TEV)	Comprehensive capital stock (assets) account	Identification of wealth; credit worthiness; important for economy- wide considerations beyond GDP	Difficulties to value land and human capital (skills); value of inter-farm collective action (as a form of social capital)
5. Societal role	Small-farm communities; villages; local services	Shows collective action (potentials); governance and fiscal settings; public goods investments	Lacks focus on the farm enterprises

Source: Braun & Mirzabaev (2015)

Small farms always are not reflected practicable, even though the facts of viability should be carefully evaluated in relation to small farms. Economic viability in family own farming means the ability and capacity of a farm to sufficiently survive, at least over the seasons of a year or over the long run. Emergent literature on small farmer innovation speaks about small farmers as innovators themselves rather than ordinary executers of innovations as often viewed. The definition of farm class sizes for which data are collected is often divergent among countries, making their cross-country comparisons challenging (FAO, 2010). Moreover, the argument of small farms is dominated by crop production, whereas small rural communities are usually not much taken into consideration, with little attention being paid to small scale horticulturalists and aqua culturalists as well.

Given the relevance of multiple job holdings on small farms, defining viability purely on the idea of the farm component of the households' total economy is inappropriate, as farm production, labor and capital allocation are optimized in an integrated, inseparable fashion in

most instances (Singh, Squire, & Strauss, 1986). The participants capabilities within the small farm sector, like entrepreneurship and expanding human capital, could also be enablers and far more relevant for innovation, development, and growth instead of simply being the economics of land connected to the tiny farm economy.

3. Innovation in Agriculture

Innovation is a method of placing knowledge into practice, whether in the shape of technology, practice, or a specific approach of functioning. Innovation role is clearly classified and confined functional or environmental space where certain technologies or practices are put into work to better existing situations through innovation program that describe group of individuals who often represent organizations with unpredictable credentials and attentions where farmers, agricultural input suppliers, traders, food processors, researchers, government officials, etc. that come together to develop a common vision, to identify solutions to common problems or to achieve common goals (FAO, 2014).

Agricultural development practices increasingly implicate complicated activities that are guided by the active collaboration of environmental and socio-economic aspects, such as trade liberalization and demands of global markets, urbanization, climate change, agricultural intensification, concentration and vertical integration of food production and consumption, as well as food safety standards and the need to ensure equitable benefits to actors along value-chains (World Bank, 2007; IAASTD, 2009; FAO, 2014). There is common understanding that, to encounter these challenges, agricultural innovation is the key. However, small farmers in Malaysia are not entirely exploiting their capacity for innovation to stimulate agricultural productivity, market competitiveness and sustainability. Consolidating the capacity of individuals and organizations, as well as that of the enabling environment in which they are surrounded, is required to aggressively promote agricultural innovation.

There are four (4) main theoretical belief related to innovative thinking approach in agriculture and rural development (Klerkx, van Mierlo, & Leeuwis, 2012a). The two latest approaches AKIS and AIS emphasis not only on the present of knowledge, but also take into matter the demand side of the equality, acknowledging the numerous measurements and complicated disposition of the innovation process.

1. Transfer of Technology (ToT)

   Era: In 1960s

   Objective: Equip technologies through linear processes

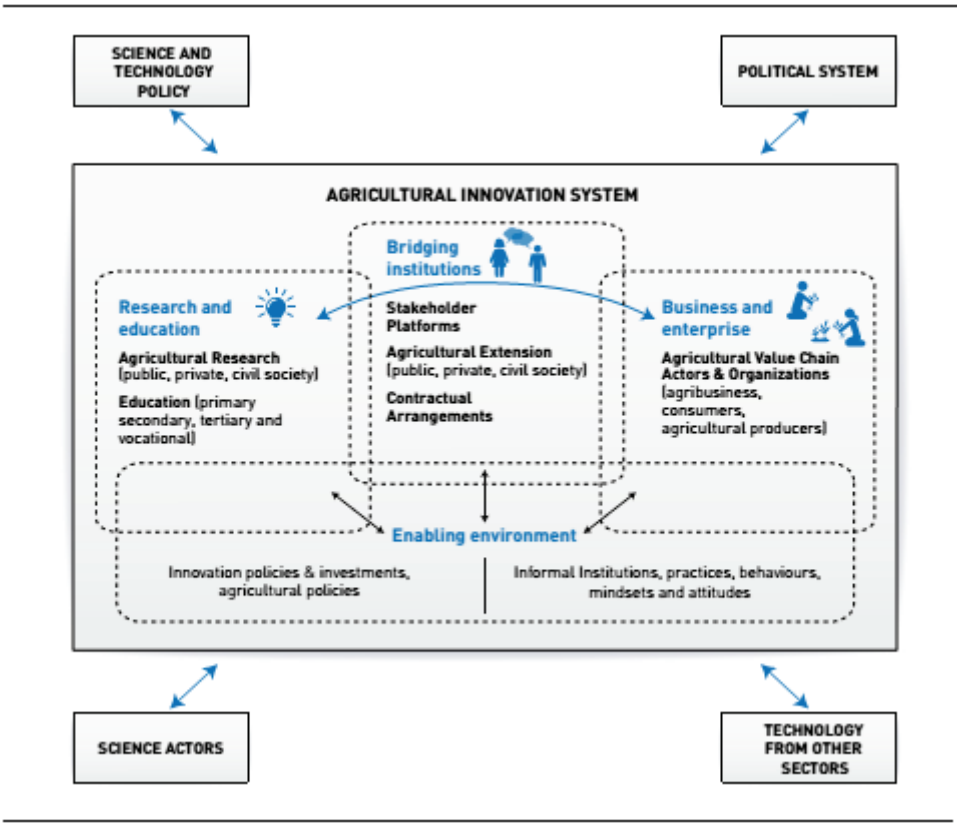
   Major transformations sought: Farmers' behavior change

   Scope: Productivity improvement

2. Farming System Research
   Era: In 1970s
   Objective: Learn farmers' limitations through surveys
   Major transformations sought: Removing farmers' limitations
   Scope: Effectiveness in achievements through input output relationships.
3. Agricultural Knowledge & Information Systems (AKIS)
   Era: From 1990s
   Objective: Work together in participatory research & expansion
   Major transformations sought: Empowering farmers
   Scope: Farm-based livings and incomes.
4. Agricultural Innovation Systems (AIS)
   Era: Since 2000s
   Objective: Together develop innovation comprising multi participant activities and collaborations.
   Major transformations sought: Institutional change, innovation capacity
   Scope: Value chains, institutional change

4. Agricultural Innovation System (AIS)

Agricultural innovation works within a dynamic group of actors, individuals and organizations which encourage collaboration and learning within adjustment and receptiveness to rising challenges and prospects. AIS stands for what is frequently called a 'complex adaptive system', whereby the system, organizations, and individuals, acquire and familiarize themselves to complicated circumstances and continuously exchanging environments. The system advances on the foundation of the countless interactions among huge numbers of elements, and function based on interrelationships among people, groups, structures, and ideas making it a highly unpredictable process (Land, Hauck, & Baser, 2009).



Source: Tropical Agriculture Platform (2016)

Figure 1 Conceptual diagram of an agricultural innovation system

In the AIS perspective, innovation happens at various levels, from the individual to national scale, when an entire sub-sector may change practices (Gildemacher & Wongtschowski, 2015). Innovation process cannot easily be transferred or replicated from one place to another where in taking a new 'practice' from one place to the next requires, by default, re-creation of

the innovation process, to ensure local fit and the re-ordering of actor relations required for its success (Gildemacher & Wongtschowski, 2015). Consequently, an innovative system involves further adjustment at local level and actors need to restructure aligning to the practice.

Agricultural innovation practices thus demand an expansion of traditional acceleration responsibilities for instance communication and information sharing, listening, organizing actors and handling logistics which to comprise promotion interaction by managing systemic exchanges that link people and resources, while improving their capacity to make collective decisions and to implement them (Pyburn & Woodhill., 2014). Local innovation system places emphasis on participant in farmers network's ideas, creativities, and skills (Wongtschowski, Triomphe, Krone, Waters-Bayer, & Veldhuizen, 2010). The idea of AIS not only demands for a change in the tasks of numerous participants in agricultural advancement,

with innovative approaches of knowledge creation, sharing and learning, and simultaneous changes in the institutional and policy setting, but it also demands for innovative and systemic approaches to capacity improvement to enable that shift.

5. Innovation Capacity

Innovations happen at every stage of the value chain as a cause of contacts between diverse stakeholders exploiting their various knowledge (World Bank, 2012). The innovation for extensive centered growth, demands a better collaborative, dynamic, and eventually adaptable and growing activity in which the participants deal at the same time with circumstances and supplementary activities that exceed past the conventional fields of R&D and expansion in farmers communities. Judging the importance of small farmer innovations, FAO (2014) appropriately requests for acknowledging the importance of family farmers and uphold them in innovating for achieving viable productivity increase. This contains the growth and purpose of new technologies and practices, including farmer-led and formal research in combination with conventional mixed farming.

Innovation undertakings demands to enable to create or organize what has been called systemic innovation capacity (Hall, 2005). This enabler defined as the capabilities of interdependent and self-organizing participants to continuously classify and priorities limitations and prospects, by react to coordinate and collaborate with others to organize new and existing knowledge, resources and capabilities, to experiment with social, technical and institutional options (Hall, 2005). Systemic innovation capacity requires that actors in projects evaluate and adaptively respond to changes within the project environment and the external social, technical and institutional environment (Ingram, 2015) where external environment consists of several levels and scales, such as administrative levels and geographical scales (Hermans, Klerkx, & Roep, 2015).

Innovation capacity is formed throughout the routines, procedures or methods used to activate, generate, and reconfigure compositions of resources and capabilities.

6. Resources

Resources are actual monetary and physical items, as well as institutions such as encouragements for innovation for instance intellectual property rights and subsidies that is used in the innovation process (Musiolik, Markard, & Hekkert, 2012). Mr. J.B. Barney champion the resource base view framework and capabilities concept in 1991. Resource-Based-View framework. According to him, resources are firm-specific assets whose value is context dependent which separated into 2 types:

1. Tangible resources include financial reserves and physical resources.

2. Intangible resources en-compass reputation, organizational culture, technology, customer relationships and human resources

Source: Author own development

Figure 2 Type of resources

7. Capabilities

There are three distinct capabilities drawn by (Boly, Morel, Assielou, & Camargoa, 2014; Wang and Ahmed, 2007):

- Innovation capabilities, which are the processes for exploring and exploiting opportunities to innovate (Wang & Ahmed, 2007).
- Adaptive capabilities, which are the development and adaptation of individual resources and capabilities, and arrangements of these, in view of a changing external environment (Wang & Ahmed, 2007).
- Absorptive capabilities, which are the processes for acquiring, assimilating and transforming external knowledge and resources (Boly, Morel, Assielou, & Camargoa, 2014; Wang and Ahmed, 2007).

Capacity is having the right configuration of capabilities in sufficient amounts to be able to successfully innovate (Boly, Morel, Assielou, & Camargoa, 2014; Hall, 2005) so capabilities represent capacity enabler. Being an emerging construct, innovation capacity enablers in AIS has not yet been investigated comprehensively in agricultural innovation, and existing work has focused on innovation capacity at specific levels, e.g., individual innovation capacity (often through the lens of entrepreneurship (Hassink, Hulsink, & Grin, 2016) and innovation capacity in or through networks (Oreszczyn, Lane, & Carr, 2010). Where studies have considered innovation capacity across AIS levels they have focused on interactions between two to three levels only, such as interactions between individual and organizational capacities (Pant, 2012), or between innovation networks and their external environment (Hermans, Klerkx, & Roep, ,2015, and Jensen & Krogstrup, 2017.

Understanding and analyzing how innovation capacity is built and how it relates to capabilities and resources can help farmers, agriculture staff and policy makers to identify gaps in capabilities, for example research and advisory organizations and more broadly in the portfolio of agricultural innovation policy instruments (Borrás & Edquist, 2013), which may lead to innovation failure and an incapability to provide recognizing the goals of agricultural and land use policies. This can notify venture to form capabilities, increase the possibility of innovation success, and would convert part of insight, strategy and technology appraisal exercises informing agricultural innovation policies (Thornton, et al., 2017) to be able to reconfigure AIS to deal with transformation settings of emerging agricultural and land management tasks further advancing land use policy programs and agriculture.

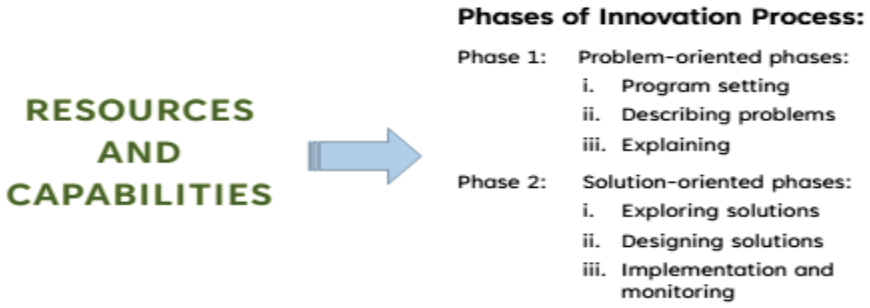
Enabler, capabilities, and capacity need to be dynamically engaged at strategic aspects in the innovation process (Hall, 2005; Schut, van Paassen, Leeuwis, & Klerkx, 2014; Davies & Brady, 2016). While we define the stages of the innovation process straightly, they will transpire non-sequentially and iteratively (Graffy, 2008).

The innovation process naturally begins with problem-oriented phases:

i. Program setting when the initial background of the problem and stakeholders were outlined.
ii. Describing problems, when the longitudinal and sequential aspects of the social, economic, institutional, and biophysical systems applicable to the preliminary scope of problem are designated, including various enablers in the systems; and
iii. Explaining problems when practices and interactions in the systems are explained through experimentation, modelling and stakeholder dialogue.

Innovation then moves to the solution-oriented phases of:

i. Exploring solutions, when conceivable innovation routes to address the problem are established and the effects and trade-offs of solution are explored.
ii. Designing solutions, when a desired solution pathway is recognized, resources and practices for its implementation are concluded; and
iii. Implementation and monitoring, when the solution pathway is employed, along with observing activities for assessing improvement toward the desired change (Schut, van Paassen, Leeuwis, & Klerkx, 2014).



Source: Author own development

Figure 3 Resources and Capabilities Engagement in Innovation Process

The above highlights that combining social, economic, institutional, and technological changes is needed to undertake complicated issues, like unsustainable land management, requires the innovation participant effectively put together the capabilities of multiple actors at different levels of the AIS, innovation capacity.

Subsequently, initiatives towards innovation, in line with the Malaysia government's future National Agri-Food Policy 2.0 strongly encouraged, as to push agriculture into the fourth industrial revolution, which will further boost productivity as published in The New Straits Times, 22 November 2018. While The Star, on 29 July 2019 quoted that negatively affected by the climate crisis, excessive development and environmental erosion, the agricultural industry will have to move quickly to adopt modern farming practices and technology to ensure food supply chain continuity. Supporting those rural farmers about innovation means strengthening these capacities, and by extension, contributing to both local and global food security, rural livelihood improvements, and agroecosystem resilience.

8. Conclusion

The world is changing rapidly as technological advances enable faster and more dynamic interaction between individuals, groups, organizations, and nations. The organizations must be able to respond to new pressures to generate the best outcomes from their most valuable assets. Strategic and transformative capabilities or innovation capacity enabler are principally significant towards the transformative objectives of agriculture innovation, encouraging new development models such as smart farming, circular economy and bioeconomy, and urban farming, as these go beyond traditional actor and capability configurations in AIS and link to other sectors such as industrial policy and urban planning. Inadequate linkages with these sectors may slow the progress toward implementing these new development models resulting the influenced by negative path dependencies and capability voids.

The primary objective of this study is to gain an in-depth understanding of how importance is innovation capacity to the rural small farmers community and various other

actors. Indeed, farmers especially from the rural areas need the support from the government in terms of up-to-date policies, and private initiatives to overcome these challenges, as well as to be able to adapt to the changing conditions (P.M.Meuwissen, et al., 2019). Thus, requires comprehensive research to accurately access the complexity of this sector. Hence, farm resilience needs to be studies with the incorporation of innovation, from vegetables to crops, to eggs, dairy products, or livestock farming. Further research on qualitative study approach should provide the opportunity to examine the real-life practices of small farmers in Malaysia.

Finally, strengthening the core elements of innovation capacity into farmers will help them enjoy sustainable farming life.

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Modern Innovative Agricultural Model for Sustainable Tourism Management in Chiang Mai Province, Thailand

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Abstract

Agritourism is the practice of local knowledge as a tool for sustainable tourism in collaboration with the sustainable agricultural process, using new concepts and paradigms that must be developed and managed to keep up with globalization. Moreover, bring the principles of community development through sustainable tourism management that creates benefits for people within the community is important. However, communities in the countries that focus on tourism development often encounter problems of poor management, which caused a negative impact on the culture or may increase the rate of social disturbance. Furthermore, it can affect changes in the behavior of people in the community and can influence changes in the environment in the local community. This research, therefore, aims to know the innovative model of modern agricultural farms of entrepreneurs in Chiang Mai Province. Additionally, to compare the differences in the efficiency of the modern agricultural farm model and to specify the modern agricultural innovation model that is suitable for agritourism management. The research site is Chiang Mai, Thailand, a model for tourism management that is popular and famous throughout the world. Mixed-method research by using semi-structured interviews and questionnaires will be applied. Thus, this research data conducted from 55 entrepreneurs on farm management that promote tourism in their farm areas and will survey 275 tourists. Significant of this study is to acquire knowledge about modern innovation agriculture that applied in agriculture of entrepreneurs in Chiang Mai to be sustainable tourism.

Keywords: *Agritourism, Modern agricultural farms, Sustainable tourism*

1. Introduction

At present, agricultural tourism has many forms which can be divided according to the area size, type, business owner, agricultural activities, and the characteristics of tourists visiting. The farmers who will start agritourism business can choose the form according to suitability and feasibility due to the area size, capital, the location, marketing, agricultural products (Wu, Y. et al, 2018). The success of the agricultural tourism destination is to generate additional income from the current primary agricultural operations. However, the new technologies in agriculture made agritourism more innovative. Thus, this research aims to study the modern agricultural model in Chiang Mai Province, Thailand. It is expected that the results of the research can be applied to develop agricultural innovation management for sustainable tourism. The concept of agritourism and related modern agriculture can be explained as follows;

1.1 Agritourism

Agritourism is the application of local knowledge as a tool for sustainable conservation and tourism following the sustainable agricultural process with new concepts and paradigms. The new development paradigm produced ideas and actions to make changes with the sufficiency economy, philosophy of existence, and practice of people. It must be developed and managed to keep up with globalization together with bringing the principles of community development with sustainable tourism management. So that it will create benefits for people within the appropriate community and help stimulate the ability to produce agricultural products or folk handicrafts. Those products can generate income for the career from the chain of tourism and increase stakeholder participation as well. However, communities in the country that focus on tourism development often encountering problems of poor management, which caused a negative impact such as social or behavior of people in the community. Moreover, it can influence change in the environment in the local community (Nicolescu, 2013).

Notably, the traveling brings the differentiation in beliefs and practices which create social exchanges by cultural products such as natural resources and motivation towards happiness in the visit to tourist sites (New Philanthropy Capital Organization, 2014: 22). However, in term of agritourism, it means tourism that focuses on learning to gain knowledge and confidence about agriculture and is also getting a relaxing vacation. For example, agricultural farms, vegetable gardens, orchards, flower gardens, and tourists themselves have experience in agriculture through various activities that occur within that tourist attraction.

1.2 Modern Agriculture

According to the policy of "Thailand 4.0" where Thailand must change from traditional agriculture to modern agriculture which focuses on management and technology that aims to bring prosperity to the community as well as increasing the proportion of income generated in local communities and the nation. (Hanhiran, S., 2016: 5). There are many words to explain modern agriculture. However, this study will discuss smart farm and precision agriculture as mentioned below;

1.2.1 Smart Farm and Smart Farmers

According to SME 2018 principles of concepts “Smart Farm” is an attempt to raise the level of agricultural development in 4 major areas, namely 1) cost reduction in the production process 2) increasing the quality of production standards and product standards 3) risk reduction in the agriculture sector which is caused by an outbreak of pests and from natural disasters and 4) knowledge management and transfer by applying information technology from research into practical development by farmer.

According to Kraipinit, Jantuk and Siriwong (2017), the Ministry of Agriculture and Cooperatives, Thailand set two main specifications of smart farmers: the income is not less than 180,000 baht/ household/ year, and the basic features consist of 6 qualifications as follows:

1. The smart farmer must know and can be the instructor of agricultural technology transfer or the consultant with others who are interested in the area of the farmer’s expert.
2. The smart farmer can use the information for making decisions and can access information sources through information technology systems, devices such as the internet, smartphones, and other digital devices.
3. The smart farmer can manage products and marketing. They must have the ability to manage production factors, labor, capital, and marketing. As well as be able to manage zero waste management.
4. The smart farmer is aware of product quality and consumer safety. They know or passed the training on organic GAP / GMP standards or other standards.
5. The smart farmer has a responsibility to the environment and society. Their production processes do not cause pollution and do not destroy the environment. Moreover, they participate in the activities to help the community and society continuously.
6. The smart farmer proud of being a farmer. They commit to agricultural career, love and cherish the area and agricultural career for the next generation.

From the specifications mentioned above, Kraipinit, Jantuk and Siriwong (2017) also mentioned that smart farmer can be divided into three groups regard to quality and safety of consumers, society, and environment which are Smart Farmer prototype, Existing Smart Farmer, and Developing Smart Farmer;

1. Smart Farmer prototype means a farmer who has already passed the consideration of being an Existing Smart Farmer and has passed the qualifications of Smart Farmer prototype in each of the ten main issues, namely, rice, palm oil, rubber, maize, cassava, sugarcane, fishing plant, livestock, integrated agriculture, young smart farmer, and other fields are prominent in agriculture in that area of each area. Moreover, they must be considered to be models and lessons for other farmers.
2. Existing Smart Farmer means smart farmers who already have the main features and pass all six basic qualifications through at least one indicator in each essential qualification.
3. Developing Smart Farmer means farmers who are not yet considered as a smart farmer because they do not pass the main features and all of the six basic qualifications. Thus, they have to be developed in various fields according to their needs.

1.2.2 Precision Agriculture

The precision agriculture is agriculture that fits the areas that are not large. This type of modern agriculture focuses on the efficiency of cultivation from seed selection to the planting process using technology to help measure both soil condition, natural light, and the various pests. Agriculture and Cooperative Office (2018) explained the key to practicing precision agriculture is three aspects of making the precision farm efficient as;

1. Identification of planting areas that leads to the cultivation of plants in the area.
2. Analysis of data that corresponds to the period of crop cultivation through decisions on correct information by helping to reduce production costs and increase productivity per area.
3. Management of areas using appropriate technology, not wasting resources, and control the quality of the product as required by the customer.

At present, it is an essential trend of farming in the 21st century, many farms have introduced the use of precision farming technology to control the accuracy of both correct irrigations, including the amount of time through the smartphone and the computer of the farm itself. The sensor is controlled to measure the temperature together with the release of water to maintain the temperature. It is trendy in the United States and Australia, and is widespread in many countries, including Europe, and Japan (Theerapong, 2010). The

problems of agricultural production in Thailand are farmers are lacking awareness and understanding of efficient use of resources. Therefore, it is essential to use technologies to provide accurate information which can lead to the right decisions.

1.2.3 Chiang Mai Province, Agriculture, and World Destination

The Ministry of Agriculture and Cooperatives has designated the Green Agriculture City Project as a flagship project of the Ministry of Agriculture. That is consistent with the national strategy to create understanding and exchange experiences in each area to become green agriculture. The selection based on the potential of the provinces and had the outstanding production of agricultural products is widely accepted. Six provinces, namely, Chiang Mai, Nong Khai, Si Sa Ket, Ratchaburi, Chanthaburi, and Phathalung were selected to be representing the model province in each region of the country to push for a green agricultural town and develop into an agricultural tourism city (Land Development Department, 2014). Chiang Mai was selected to be one of the essences of the six master provinces jointly set the area to be developed into a green area to have a process of producing agricultural products that are safe from chemical residues and use clean technology to produce green agriculture.

Moreover, Chiang Mai has taken third place in a list of the 15 best city destinations in the world for 2017 which ranked by Travel +Leisure World's Best Awards: The World's Top 15 Cities (Terzian, 2019). Thus, Chiang Mai is qualified to be the location of this study to investigate the model of modern agricultural innovation that is appropriate for agritourism management. This study should contribute important data to the professional and academic in these fields.

2. Objectives

1) To know the innovation model of modern agricultural farms of entrepreneurs in Chiang Mai Province
2) To compare the differences in the efficiency of the modern agricultural farm innovation model
3) To identify the model of modern agricultural innovation that is appropriate for agritourism management

3. Scope of the Study

This research focuses on the innovation of modern agricultural farms, which can be classified into four types: 1) Smart Farm 2) Precision Agriculture 3) Precision Farming and 4) Smart Farmer. This study examined the raising of the level of agricultural development in 4 major areas: 1) Cost reduction in the production process 2) Quality enhancement production standard and product standards 3) Risk reduction in agriculture and 4) management and

transmission of information technology knowledge.

In term of sustainable tourism development in this research was determined by the five important elements that are related and with the aim of agricultural tourism To contribute to sustainable community development, namely 1) tourism policy and governance 2) economic performances, investment, and competitiveness 3) Human resource development for employment and human capital efficiency 4) Poverty reduction and social inclusion and 5) sustainability of the natural and cultural environment.

4. Methodology

4.1 Population and Sample

This research was collected data from the population in the Chiang Mai province. The sample of this study are the farmer that promote tourism in their own farm areas which are19 organic agricultural market groups, 10 agricultural product processing groups, 7 groups of organic farms, 6 organic agriculture accommodation groups, 5 groups of organic vegetable gardening groups, 3 Agritourism Groups, 3 agribusiness groups, 2 Smart Farm Groups. Total of 55 locations for this study. Moreover, agricultural tourists were examined their views on agritourism. Thus, the research team used the accidental sampling by determining the proportion of sample size in each place. By distributing 5 cases per 1 place, totaling 275 persons.

4.2 Data Collection and Data Analysis

Data collection methods in this research consisted of survey data, both data from secondary data and primary data by creating data collection tools as follows;

1) Using semi-structured interview forms to collect information from modern agricultural farm business operators on issues of various variables such as the pressure of modern farm business operators, marketing, environment, education, and awareness of modern farm on eco-innovation.
2) Using questionnaires to gather information from agricultural tourists about eco-innovation awareness, including the behavior of tourists towards the modern agriculture farm on eco-innovation
3) After the data collection process, content analysis techniques were used to analyze the data, which divided into two parts; 1) transcripts content from documents, photos, and interview recording. Then, synthesis, analysis, selection, and interpretation the data by applying knowledge in the theory and concepts in research and 2) using descriptive statistics from qualitative data which was done with the tourists. This study was used inferential statistics according to the level of the data such as x2-test for nominal and ordinal scale.

5. Conceptual Framework

Modern Innovative Agricultural Model	
Large	• Total production • Precision farming • Comparable to the best performance / quality (benchmarking)
Medium	• Production contract for full use of machines (utilization) • Total purchase, total production, distribution • Modern farmers (smart farmer)
Small	• Grouping for agricultural tools • Grouping to use contractors • Grouping to buy production factors • Agricultural products, generating quick cash (cash crop) • New Agricultural Theory - Sufficiency Economy

⇔

Sustainable Tourism Management
• Policy formulation and tourism management • Increasing investment efficiency and economic competition • Human resource development to be effective for the position and employment • Reducing poverty and social gaps • Sustainable development of natural and cultural environments

Figure 1 Conceptual Framework

6. Result and Discussion

According to Mastronardi et al. (2015) the presence of agritourism farms in farming systems falling in forests and protected areas has positive impacts on biodiversity and natural resources since they develop more sustainable practices. Several works found that agritourism plays a relevant role in soil protection and in hydrogeological disaster prevention. Hence, agritourism represents a form of sustainable tourism able to conserve and develop rural landscapes and biodiversity. Few studies emphasize the role of agritourism as a means to promote the responsible use of natural resources. According to Giurea et al (2018), agritourism is a link to redesign the terms of consumption and waste for non-renewable energy sources. Re-using, recovering, re-developing, regenerating, and valorizing resources, must be considered as a frame of reference for sustainability in agritourism. Carlsen et al. (2001) and Choo and Jamal (2009) found a very strong inclination of farmers toward environmentally friendly practice adoption, including water conservation procedures, recycling programs for materials, and guest's education on conservation matters. Many agritourism entrepreneurs are developing greater sensitivity in the exploitation of natural resources to produce energy with zero environmental impact. Moreover, agritourism

represents an opportunity to reduce food waste and reuse unsold products. Composting at the farm is usually done with some leafy leftovers from the garden, and the food leftovers can be safely used to feed animals. Agricultural products unsold through traditional channels can be used in restaurant services or to produce marketable foodstuffs (e.g., fruits turned into jam, vegetables preserved in oil). Agritourism represents an important job opportunity, especially for young farmers. Agritourism represents a means to provide employment for family members and an opportunity to plan farm succession, in order to preserve the business for future generations. Transgenerational continuity of the family farm is imperative for agribusiness activity. According to Brandth and Haugen (2011), agritourism represents a great opportunity to maintain and renew the farm and its assets. The researcher found that taking care of the farm resources and improving them for successors is a typical characteristic of farmer mentality: farm owners continue to take care of and build on local traditions and continuity, albeit for commercial reasons.

7. Conclusion

This study was investigated the innovation model of modern agricultural farms of entrepreneurs in Chiang Mai Province and compare the differences in the efficiency of the modern agricultural farm innovation models that is appropriate for agritourism management. This research focuses on the innovation of modern agricultural farms such as Smart Farm, Precision Agriculture, Precision Farming, and Smart Farmer. On the other hand, this research determined by the five important elements that are related to agricultural tourism 1) tourism policy and governance 2) economic performances, investment, and competitiveness 3) Human resource development for employment and human capital efficiency 4) Poverty reduction and social inclusion and 5) sustainability of the natural and cultural environment. This research is expected to collect data from the population in the Chiang Mai province. The data collection was done with 55 owners of farms which presented themselves as agritourism destination in Chiang Mai, Thailand, for this study. Moreover, 275 samples of agricultural tourists were examined their views on agritourism. Therefore, this study will contribute valuable data on modern innovation agriculture that applied in agriculture of entrepreneurs in Chiang Mai to be sustainable tourism.

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Improve Taiwan Quinoa Growth Traits and Antioxidant Capability by Application of Calcium Carbonate

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Abstract

We investigated the effects of calcium carbonate ($CaCO_3$) on the growth and physiology of Taiwan quinoa (commonly known as djulis) because calcium is an essential nutrient for plants that can strengthen a plant's root system and improve its nutrient absorption. Experiments were conducted using djulis sprouts as material at first. Treatment with 5 mM calcium carbonate promoted the growth of djulis; specifically, root length, plant height, aboveground fresh weight, and dry weight increased by 55%, 12%, 37%, and 17%, respectively. In further investigation of the physiological change of djulis sprouts treated with calcium carbonate, the results showed that after 5 days of treatment with 5 mM calcium carbonate, the contents of hydrogen peroxide and malondialdehyde decreased significantly while the chlorophyll content increased significantly. Antioxidant enzyme activity was significantly improved. The activities of superoxide dismutase, catalase, ascorbate peroxidase, and glutathione reductase were increased by 42%, 25%, 35.7%, and 56.4%, respectively, and the calcium content of the aboveground and underground plant parts was increased fourfold and threefold, respectively. Then, in terms of field experiment, after being treated with $CaCO_3$, djulis was found that the growth traits such as plant height, stem thickness and number of nodes increased significantly during the growth period. In addition, djulis can also increase the yield after calcium treatment. Thus, we concluded the treatment of djulis with 5mM $CaCO_3$ not only can improve growth and antioxidant capacity, but also can increase the yield.

Keywords: *djulis; growth traits; antioxidant enzymes; calcium carbonate; yield*

1. Introduction

Djulis (*Chenopodium formosanum* Koidz.) is a herbaceous dicotyledonous annual plant belonging to the Chenopodium genus. It is native to Taiwan and has an affinitive relationship with Chenopodium quinoa Willd. Having similar growth characteristics as *Chenopodium quinoa* Willd., djulis features shallow roots and spike-type inflorescence; the plant can reach a height of up to 3 m, and the main and lateral branches can grow seeds. Similar to the grains of the Poaceae family, the seeds of djulis are also known as pseudocereal. The seeds of djulis contain numerous elements necessary to the human body, including amino acids, minerals, a large amount of dietary fiber, starch, protein, and antioxidants (e.g., betaine and polyphenols) (Tsai et al. 2010). In particular, its content of minerals—potassium, phosphorus, calcium, and magnesium—is higher than that of cereal. Therefore, it has been selected as an alternative food crop for the future (Koyro and Eisa 2008).

The mineral calcium is an essential nutrient for plants. It is mainly distributed in cell organelles such as the cell wall and endoplasmic reticulum and cytoplasm, and it plays a major role in regulating plant growth and development (Thor, 2019). To increase the growth potential of crops, exogenous calcium is often applied to crops during the growing period. When common soybeans are treated with increasing concentrations of calcium, the dry weight of soybean stems, leaves, and roots and the grain yield correspondingly increase (Domingues et al., 2016). In rice, applying exogenous calcium before heading can increase the carbohydrate content in flag leaves by 15% and transport it to grains for storage (Feagley et al., 1998). Furthermore, applying exogenous calcium to fruits and vegetables after harvest can extend their storage time and maintain their quality (Kou et al., 2014; Tsantili et al., 2002).

The content of calcium ions in plant cells is related to plant adaptation to external environmental stimuli (White & Broadley, 2003). For crops grown under stressful conditions such as high temperature (Tan et al., 2011), drought (Xu, Li, & Zhang,2013) and high salinity (Cheng et al., 2013), treating them with calcium increases the activity of antioxidant enzymes, such as superoxide dismutase (SOD), catalase (CAT), ascorbate peroxidase (APX), and glutathione reductase (GR), which can reduce the content of active oxygen and improve the stress tolerance of the crops. Calcium treatment reduces the damage to crops when they are grown in an environment in which heavy metals such as cadmium (Ahmad et al., 2015), nickel (Siddiqui et al., 2011), or arsenic (Rahman et al., 2015) are present.

Because few studies have investigated the effects of exogenous calcium treatment on the growth and physiological response of quinoa or djulis, this study sought to understand the effect of $CaCO_3$ on the growth and physiological changes of djulis.

1.1 Materials and Methods

(1) Sprouts experiment

The seeds of djulis were placed in a petri dish to accelerate their germination. Subsequently, they were grown hydroponically, and the nutrient solution was formulated according to the crop testing method proposed by Yoshida et al.. The djulis plants were grown at room temperature and were illuminated by a 30,000 lux fluorescent light for 24 h. After the first leaf was fully expanded, the plants were moved to a controlled environment greenhouse to grow for 1 wk. The temperature of the greenhouse was controlled at 25ºC-30ºC, and the lighting was natural light.

After the djulis had grown for 1 wk, they were variously treated for approximately 3-5 d with nutrient solutions containing 5 mM $CaCO_3$, and the resulting plant heights, fresh weights, and dry weights were measured. Ten djulis plants were collected from each treatment for measurement, and this process was repeated three times.

(2) Field experiment

Seeds of djulis was used in the experiment. After the seeds were grown in a greenhouse for 4 weeks, they were taken and planted in fields. Two weeks after planting in the fields, 5 mM calcium carbonate was sprayed on the leaves once every week until Week 9 for a total of three treatments. From Weeks 2 to 9, changes in the height of the plants, number of branches, diameter of stems, and number of internodes were recorded. Djulis were grown until Weeks 16, analyze the yield components.

(3) Physiological parameter assays

The chlorophyll assay was performed using the method proposed by Wintermans and De Mots. The malondialdehyde (MDA) assay was conducted according to the method proposed by Heath and Packer. A hydrogen peroxide assay was conducted using the method proposed by Jana and Choudhuri.

(4) Analysis of antioxidant enzyme activity

The first pair of leaves (including the terminal bud) of djulis plants was collected and ground in an ice bath of 0.1 M sodium phosphate buffer (pH 6.8) and was centrifuged at 12,000 rpm at 4ºC; the supernatant was used as the extract in subsequent analyses. SOD activity was determined using the method of Paoletti et al.. CAT activity was determined using the method of Kato and Shimizu. APX activity was determined using the method proposed by Nakano and Asada. GR activity assay was performed using the method of Foster and Hess. The protein content of the enzyme extract was determined using the method of Bradford.

(5) Statistical analysis

All the assays were performed on the basis of completely randomized design. SAS 9.4 (SAS Institute Inc.) was employed to calculate the least significant difference to determine the differences between various treatments ($p \leq 0.05$).

1.2 Figures, Tables and Picture

Djulis sprouts were grown for 1 wk and then placed in hydroponic solution variously supplemented with 0, 1.25, 2.5, and 5 mM $CaCO_3$ for 7 d, after which the root length, plant height, and dry and fresh weights of above- and belowground parts of the sprouts were measured. As evident in Table 1, for treated sprouts on average, the root length was 3.74 cm, plant height was 6.64 cm, fresh ground weight was 1.25 g, and dry ground weight was 0.18 g, all of which were higher than those of the control group. Moreover, plant appearance improved with 5 mM $CaCO_3$ treatment. No significant difference was identified between the dry and fresh weights of the underground parts treated with and without $CaCO_3$ (Table 1). Thus, the results showed that 5 mM was the optimal $CaCO_3$ treatment concentration.

Table 1 The effect of calcium carbonate on the growth traits of Djulis sprouts. The 7-d-old djulis plants were treated with 0 mM, 1.25 mM, 2.5 Mm and 5 mM $CaCO_3$ for 3 days, the growth characteristics of seedlings were investigated. Data are means ± SE (n = 10), repeated three times. Values with the same letter are not significantly different at $P < 0.05$.

$CaCO_3$ Concentration (mM)	**Root length (cm)**	**Shoot height (cm)**	**Shoots**		**Roots**	
			Fresh weigh (g)	**Dry weigh (g)**	**Fresh weigh (g)**	**Dry weigh (g)**
0	2.41 ± 0.11 [b]	5.90 ± 0.04 [b]	0.912 ± 0.01 [b]	0.162 ± 0.002 [b]	0.082 ± 0.024 [a]	0.022 ± 0.001 [a]
1.25	2.33 ± 0.37 [b]	5.96 ± 0.3 [b]	0.984 ± 0.11 [ab]	0.168 ± 0.019 [b]	0.090 ± 0.008 [a]	0.025 ± 0.002 [a]
2.5	2.53 ± 0.08 [b]	6.26 ± 0.03 [ab]	1.064 ± 0.11 [ab]	0.163 ± 0.023 [b]	0.115 ± 0.011 [a]	0.024 ± 0.003 [a]
5	3.74± 0.24 [a]	6.64 ± 0.1 [a]	1.252 ± 0.05 [a]	0.189 ± 0.014 [a]	0.109 ± 0.033 [a]	0.027 ± 0.006 [a]

Growing time was assessed next. Djulis sprouts were grown for 1 wk and then placed in 5 mM $CaCO_3$ hydroponic solution for 3, 5, or 7 d. No significant difference was evident in plant height, but root length, fresh weight, and dry weight of the underground parts all increased as treatment duration increased. Thus, treating djulis sprouts with calcium for 5 d was optimal treatment time.

In the next experiment, djulis sprouts were treated with 5 mM $CaCO_3$ for 5 d, after which the changes in chlorophyll, H_2O_2, and MDA contents were detected. The chlorophyll content of djulis sprouts treated with $CaCO_3$ was significantly higher than that of the control group,

whereas the contents of H_2O_2 and MDA were significantly lower than those of the control group (23.5% and 23.7% reductions, respectively). Thus, treating djulis sprouts with calcium can reduce the content of H_2O_2 and MDA, thereby increasing the chlorophyll content.

The next experiment assessed whether calcium treatment affects antioxidant enzyme activity in djulis sprouts. The activity of the antioxidant enzymes SOD, CAT, APX, and GR was significantly higher in djulis sprouts treated with 5 mM $CaCO_3$ for 5 d than in the untreated group, with increases of approximately 42%, 25%, 35.7%, and 56.4%, respectively (Figure 1). Thus, the treatment of djulis sprouts with calcium can increase antioxidant enzyme activity.

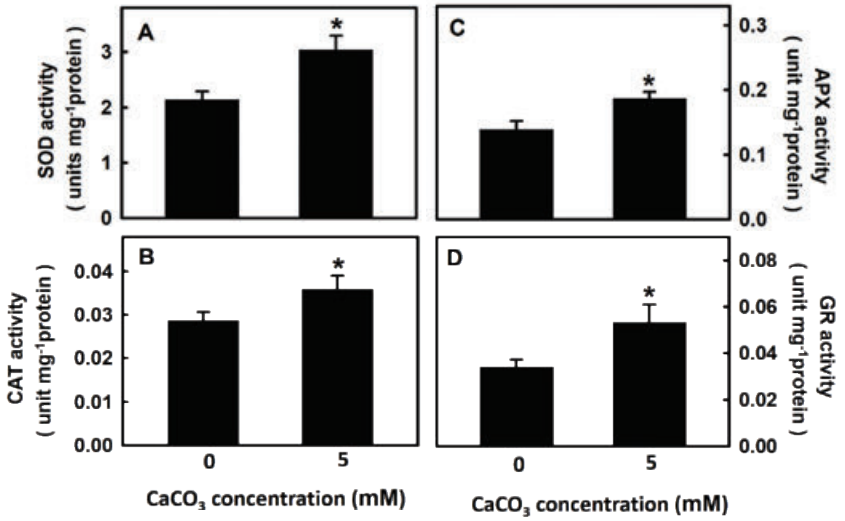

Figure 1 The effect of calcium carbonate on antioxidant enzyme activities of Djulis sprouts. The 7-d-old djulis plants were treated with 5 mM $CaCO_3$ for 5 days. The SOD (A) CAT (B) APX (C) and GR (D) activities of djulis were measured. Bars show means ± SE (n = 4). Asterisks represent values that are significantly different between calcium carbonate concentration 0 mM and 5 mM at $P < 0.05$.

In the field experiment results shown that the plant height, stem diameter, and number of internodes of djulis were significantly improved after being treated with calcium carbonate. Finally, results for the analysis yield components shown that djulis with calcium carbonate treatment can increase spike length and 1000-grain weight, thereby increasing the total yield.

In this study, treating djulis with $CaCO_3$ increased antioxidant enzyme activity, which in turn reduced H_2O_2 content. Therefore, the decrease both in H_2O_2 and MDA content probably display that reduce lipid peroxidation to maintain chloroplast membrane structure, increase chlorophyll content and ultimately promoted the biomass and improved yield of djulis (Figure 2).

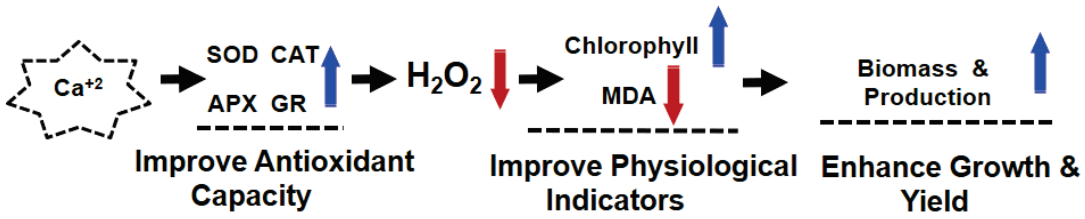

Figure 2 Mechanism of calcium carbonate to promote the growth of djulis.

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Why APMI Is Important to Agriculture

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Abstract

Purchasing Manager's Index (PMI) is the key indicator to measure the manufacturing activities; it is also the Economic Monitor Index being used internationally, which makes PMI a valuable tool to monitor and predict national economic activities. For Taiwan agricultural industry, it should a tool for farmers and government to measure the performance of Taiwan agriculture industry. The research aims to explain Agricultural Purchasing Managers Index (APMI) is important to agriculture from the measurement indicators of the PMI index. The research provides a comprehensive and objective investment reference and economic conditions for farmers and the government to make decisions in order to master industry and market changes and develop effective planting time and sales strategies.

Keywords: *Agricultural Purchasing Manager's Index (APMI), Purchasing Manager's Index (PMI), Agriculture*

1. Introduction

Purchasing managers' index (PMI) is a monthly seasonally adjusted weighted composite diffusion index of five indicators of economic activities in the manufacturing sector (Harris, 1991; Lindsey & Pasvur, 2005; Raedels, 1990; Peláez, 2003). The main feature of PMI is timeliness. It publishes data on the first working day of each month and provides leading indicators to measure economic changes. PMI can use past leading data to measure economic changes as a reference indicator, which has a great reference value. Koenig (2002) pointed out that PMI can reflect the overall growth or decline of the manufacturing industry. Pelaez (2003b) confirmed that PMI has a positive relationship with GDP, and PMI can be used as a predictive indicator (Larrain, 2007). Therefore, it is confirmed that PMI can be used as a forecast to measure the country's economic prosperity. Kauffman (1999) and Pavur (2005) mentioned the five importance of PMI: (1) Validity and reliability, (2) Timing, (3) Timeless, (4) Stability, and (5) No revisions. In 2008, ISM also released the Non-Manufacturing Index (NMI) combining four items, such as Business. Activity, New Orders, Employment, and Suppliers Deliveries. In recent, NMI has still been released by some countries for several industries or products, including agriculture. Furthermore, there is an absence of an agricultural index to describe the macro-economic status of the market. Agricultural companies and government departments have no information except for agricultural gross domestic profit (GDP) to measure the current agriculture industry (Tien, 2018). Therefore, the purpose of this research is to explore the importance of Agriculture Purchasing managers' index (APMI) from the perspective of Purchasing managers' index.

2. Literature Review

2.1 Purchasing Manager Index (PMI)

The Institute for Supply Management (ISM) (1980) proposed the Purchasing Managers Index (PMI) comprehensive index, which sets PMI for manufacturing, PMI for non-manufacturing, and PMI for service industries according to different industry sectors. The main purpose is to measure industry indicators. The PMI survey questionnaire is mainly to understand the current status of industrial activities. Through the results of various comprehensive indexes, it can reflect the overall growth or decline of an industry field as soon as possible and hope to further measure the country's industrial economy. The PMI is advantages include timeliness; reliability; and a predictor of changes in industrial production, real gross domestic product (GDP), real inventories, real sales, sales/inventory ratio, federal funds rate, foreign exchange returns, and monetary policy (Berge & Jorda, 2011; Neely & Day, 2010; Ozyldirim et al, 2011). Niemira et al (1998) pointed out that economic indicators

and economic policies have a great impact on traders and investors. If favorable economic analysis tools and methods can be provided to make appropriate decisions, they pointed out the corporate manufacturing report published by ISM The PMI can be used as an important indicator to measure economic activity, and the indicator has a positive relationship with GDP (Pelaez, 2003a).

PMI survey released for executive representatives over 400 business in 20 manufacturing industries, expanded across to 50 states which made public in the middle of each month. In the PMI survey, purchasing managers or executive representatives were asked with a questionnaire. The present month of their business was evaluated to compare with the previous month received about what was three-level, such as "higher than", "lower than" or "the same", of the business production, new order, employment, inventories, order backlogs, new export orders, and imports of materials and supplies. In order to maximize the correlation of the PMI with the real GDP, since 1982, the PMI has been constructed as the weighted average of five indexes, included Inventories, New Order, Production, Employment, Supplier Deliveries, and Inventories (Cho and Ogwang, 2007).

PMI and NMI were authorized by the Taiwanese Council for Economic Planning and Development to Chung-Hua Institution for Economic Research in 2011. A year after, Taiwan Manufacturing PMI has been released monthly till today (陳馨惠, 2011). This questionnaire is based on the content of the US ISM questionnaire. The items include new orders, production, employment level, supplier deliveries, inventory of purchase materials, price of commodities, backlogs of works, new export orders, customers inventories, imports of materials, economy, etc.. The calculation method refers to the current compilation method of the US ISM, and the five diffusion indexes, including new orders, output, employment level, supplier delivery, and purchased material inventory, are used to obtain a comprehensive index in an equal-weighted average method.

Based on the above, PMI is to understand the current situation of industrial activities and to formulate industrial strategies early through the calculation of various indicators. However, Taiwan’s agricultural economy is developing vigorously, but there are no index items like the Purchasing Managers Index that can provide data analysis for farmers and related companies. Therefore, the existing PMI can be used to develop APMI for sustainable agricultural development.

2.2 PMI Weight Distribution

ISM (1980) proposed the Purchasing Managers Index composite index, which includes new orders, output, number of employees, supplier delivery time, and procurement inventory. The weights of each item are as follows:

PMI= (New order + output + Employed population + Supplier delivery time + Purchase inventory) /5

= 0.2*New order + 0.2*Output + 0.2*Employed population + 0.2*Supplier delivery time + 0.2*Purchase inventory (1)

ISM (1982) modified the weight ratio of the Purchasing Managers Index composite index, and its project weights are as follows:

PMI= 0.3*New order + 0.25*Output + 0.2*Employed population + 0.15*Supplier delivery time + 0.1*Purchase inventory (2)

Most of today use the five component items and weight distribution proposed by the ISM in 1982. This weight distribution method has the greatest correlation with the US GDP (Bretz, 1990; Torda, 1985).

Peláez (2003a) uses regression methods to propose CWI based on GDP growth rate and uses a new weight coefficient to measure PMI. The CWI formula is shown in (3). Among them, NOI means new orders, EMI means employment, Price means ISM's manufacturing material input price diffusion index, $Price_{t-2}$ means material input price diffusion index two quarters lagging behind, $\triangle SD_{t-2}$ means supplier supply two quarters lagging behind Time difference is used as an indicator tool for GDP growth rate and industrial production growth rate.

$$CWI_t = 1.08NOI_t + 1.14EMI_t - 0.2Price_t - 0.51Price_{t-2} - 0.5\triangle SD_{t-2} \quad (3)$$

Peláez (2003b) uses the data from January 1966 to January 2003 in the United States as a basis and uses regression analysis to fix the NES weights as new orders (0.8), employment (0.43), and supplier supply time (-0.23).

Cho and Ogwang (2005) used U.S. data from January 1948 to October 2004 to conduct principal component analysis and proposed the weight distribution of new orders (0.203), output (0.210), employment (0.215), supplier supply Delivery time (0.189), purchase inventory (0.183).

In summary, the original Purchasing Managers Index comprehensive index includes new orders, output, number of employees, supplier delivery time, procurement inventory, and other indexes, but because scholars have different research purposes, the index and analysis methods used are also different. Different, the weights obtained from the analysis results are also different.

3. Discuss the Importance of APMI from PMI

Due to the diversified types of agricultural industries, such as rice, animal husbandry,

poultry, and aquaculture and fisheries, all belong to agriculture.

In order to understand the content of the APMI index, this research is based on the production quantity, new orders, number of employees, delivery time, and price developed by Taiwan's China Economic Research Institute. The design of the APMI index is explained as follows, PMI and APMI index. The content is shown in Table 1.

3.1 Productivity

The production volume referred to by Purchasing Managers Index is the change in the production volume of a company compared to the production volume of the previous month.

However, as far as agriculture is concerned, there is no chance of harvest every month. Take rice planting as an example. The main harvest is twice a year, and there is no production record every month. In the case of animal husbandry, poultry, and aquaculture fisheries, if there is a certain area and area of breeding grounds, it is possible to have a harvest every month. Based on the multiple cultivation or breeding categories of agriculture, this research proposes the slaughter volume, transaction volume, and total product weight as APMI's Productivity measurement indicators.

3.2 New Orders

The new orders referred to by the Purchasing Managers Index are the changes of companies from the new orders last month. After an enterprise receives a new order, it must start production, order raw materials, or provide services. Since the harvest period of agriculture is fixed, that is, it takes a certain time for raising or planting to harvest, and most farmers have fixed and cooperative peasant associations and cooperatives. The new order part depends on government agencies and relevant agricultural units to expand emerging markets or sales channels. Market demand for production planning and improvement of the quality and quantity of agricultural products. Therefore, this study proposes to use new transaction volume/new slaughter volume as APMI's New orders measurement indicator.

3.3 Employee

The number of manpower employed by Purchasing Managers Index is a measure of the increase or decrease in the number of employees hired by the manufacturer in the month of the interview compared with the previous month. Generally speaking, companies often decide on the amount of manpower to invest based on orders and production conditions. The particularity of agriculture is not like the manufacturing or service industry depending on the economic situation. It adjusts the number of employees in a timely manner to achieve the production number. Agriculture will determine the number of hires when the number of manual employment is based on its own planting area or breeding area. This study proposes to

use the number of farms (planting area/raising area) as APMI's Employee measurement index.

3.4 Lead Time

The Lead time referred to by Purchasing Managers Index is the time required for the company to complete work and service. The completion of work or service time for agriculture depends on the type of cultivation or breeding. For example, rice is harvested twice a year, fish depends on the variety of breeding time, and broiler chickens can be raised for 35 days. This study believes that the original indicator name can still represent the delivery time of different agricultural types, so lead time is maintained as the lead time measurement indicator of APMI.

3.5 Price

The Price referred to by Purchasing Managers Index can be divided into the price of raw materials and the price of sales. Due to the differences in agriculture, farmers who grow rice, fruits, and vegetables spend very little on raw materials, mainly fertilization and pesticides. Feeds are provided in the aquaculture industry. Expenditure on nutritional supplements. The prices of agricultural products are susceptible to changes in weather and supply, resulting in mixed fluctuations or short-term fluctuations. Climate variability has caused a decrease in the number of agricultural products such as fruits, pigs, chickens, and eggs. Furthermore, because agricultural products are sold in different ways, they will also cause different prices for sales at the origin, retail, and import and export sales. Therefore, this study proposes to use Product average price as the APMI Price measurement index, which can be calculated based on actual demand and included in the relevant price index.

Table 1 APMI variables correspondence to PMI

Chung Hua Institution for economic research selected variables for the non-manufacturing index	APMI variables
Productivity	Slaughtered amount /Traded amount/ Total weight
New Orders	New traded amount/ New slaughtered amount
Employee	Farms amount
Lead Time	Lead time
Price	Product average price

Because the PMI indicator is extremely important as a predictor of economic development (Simpson & Ramchander, 2008). Many scholars believe that if PMI can be predicted more accurately, they can further understand the future economic development direction (Larrain, 2007; Lindsey & Pasvur, 2005; Raedels, 1990). The APMI proposed in

this study is also important for predicting the development of the agricultural economy. If the comprehensive index of APMI can be accurately calculated, it is also possible to develop strategies to respond to the development of agriculture. In addition, calculate the average value of APMI as APMI threshold which is also referred as a cut-off point. If the monthly APMI of the industry compares to last month higher than the threshold, which indicates economic expansion if monthly APMI compares to last month remain the same, which indicates economic stabilization, and if monthly APMI is lower than the threshold, which indicates economic recession. There are many researches on data analysis that can effectively predict PMI. Different calculation methods and big data analysis are used to effectively mine, analyze and predict future economic conditions, providing companies and industries with a competitive advantage in response to the dynamic business environment.

5. Conclusion

Agriculture is affected by global marketization and climate change. Countries have paid attention to the importance of non-market factors on agricultural production. As the agricultural economy is closely related to daily life, it is a prosperous indicator for predicting the agricultural production economy for the benefit of farmers and agricultural authorities in drawing up planting plans. Painting and policy are imperative. In terms of forecasting economic prosperity, past studies have confirmed that PMI can be used as a measure of manufacturing growth rate and further forecast economic prosperity. This research refers to the PMI indicator and proposes the APMI indicator, which is divided into productivity, new orders, employee, lead time, and price. It is hoped that APMI can also have the function of PMI, which can effectively be used as a measure of agricultural growth rate and predict the development of the overall agricultural economy. In addition, this study only proposes the content of the APMI index. Follow-up studies can refer to this index to be applied to agriculture, such as rice, pork, poultry, fishery, etc., to establish the index weight of the forecast model as reference data for farmers when planting crops or breeding.

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The Key Factors of Successful Cross-Border E-Commerce Advancement in Southeast Asia: Grey Relational Analysis of Sustainability

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Abstract

Taiwanese e-commerce businesses are currently accessing their expansion into Southeast Asian markets. This study analyses the key factors that cross-border e-commerce businesses must possess to achieve success in the Southeast Asian markets under the concern of sustainability. Retrieved factors were used in the formation of surveys for both Taiwanese and foreign parties in which the results will be analysed using grey relational analysis. Eventually, the findings and determined key factors from the analysis will be discussed and combined with related The New Southbound Policy and Productivity 4.0 policies of the Taiwanese government.

Keywords: *cross-border e-commerce, sustainability, grey relational analysis, new southbound policy, productivity 4.0*

1. Introduction

The Taiwan Ministry of Economic Affairs ROC reported that the country's e-commerce transactions remain a double-digit growth each year. Revenue from retail e-commerce in Taiwan reached NT$221.2 billion in 2016, and the annual growth rate was 12.3% (Taiwan Network Information Center, 2018). However, statistics have also shown that the growth rate has significantly slowed down due to current saturation. The Taiwanese e-commerce industry has been in development for over 20 years and is now in the maturation period. Many online e-commerce platforms, such as PChome, Ruten, and Yahoo, have emerged on the island. A mixture of local retailers, such as PXMart and AMart, have also gone online in pursuit of the trend. Telecommunications industries are also booming, acting as a synergy to the progress of the Taiwanese e-commerce industry. The size of an e-commerce transaction is evaluated by the number of consumers on the internet and the amount of consumption. Mainland China has around 730 million internet population and almost 467 million online shopping population that are potential consumers, compared to Taiwan's net population of around 20 million, with an estimated 85% (17 million) of whom shop online in 2016. The difference in potential buyers between the two markets is nearly 37 times. The net population and online shoppers in Taiwan have not ceased to increase since 2013, rising from only 17.98 million to 19.93 million and 13.53 million to a total of 16.8 million, respectively, in 2016. However, the island's economic annual growth has gradually decreased from 12.42% to only 6.46%, signifying the fact that the e-commerce market in Taiwan has gradually reached saturation. This is also one of the main reasons why the Taiwanese e-commerce industry has been extremely active in seizing opportunities for outward expansion. There are still many restrictions on product imports and exports in cross-border e-commerce. These limitations are mainly established to protect local businesses, yet they create great obstacles and make it harder for foreign investors, especially smaller businesses, to gain access to the market. Logistics costs are higher; the delivery time is longer for goods that must be tested before entry, and there are many variables and additional fees in cross-border transactions and delivery. There are other issues, such as adaptation to local consumption habits, laws and regulations, business models, existing competitors, customs clearance processes, and commodity quality inspections, which must be considered. Trade agreements between countries could also be in the way of smooth cross-border e-commerce development. Cross-border e-commerce is a relatively young business in comparison to many other Taiwanese industries, which results in the limitation of relevant research, literature, and actual cases of Taiwanese cross-border e-commerce entering the Southeast Asian market. This triggered the motivation of study to determine the key factors and awaiting challenges for cross-border e-commerce to achieve success and sustainability in these regions, and to act as a

reference for local e-commerce operators that are currently assessing investing abroad. The findings of the study could also aid the internationalisation process of Taiwanese e-commerce businesses."

This study aims to assess the key factors that current cross-border e-commerce companies should possess or improve to achieve success and sustainability in the Southeast Asian market and to determine how to maximise their benefits in coordination with Executive Yuan's New Southbound Policy and Productivity 4.0. The literature on the characteristics of current cross-border e-commerce platforms is reviewed to shape the list of important factors, which will be later analysed using a grey relational analysis model to determine their correlation. Discussions will also focus on the current situation, potential challenges, and future predictions of the Southeast Asian market to better merge the findings with the determined key factors.

The study contributes to the literature in multiple ways. First, it provides cross-border e-commerce businesses with the top six most influential factors for advancing in the Southeast Asian market, along with their categories. The findings of the study are cross-filtered by two different groups of respondents, Taiwanese and foreigners, to enhance credibility. Furthermore, the study's findings will aid in the discussion about the sustainability of business in the Southeast Asian market, which has rarely been addressed by the current literature. Lastly, directions and recommendations are provided for future cross-border e-commerce companies on how to cooperate with and use some items in the two freshly launched Taiwanese governmental policies, the New Southbound Policy and Productivity 4.0, to their own advantage.

2. Cross-Border E-Commerce

E-commerce businesses tend to be confronted by matters such as information flow, finance flow, logistics, online security, community management, marketing, customer service, etc. Given that the area covered by "cross-border" e-commerce is much wider than the traditional e-commerce business, it is undoubtedly impacted by even more factors, deriving from three categories—economy, society, and environment (Wang, 2016). In general, cross-border e-commerce is an international online trade that entails the sale or purchase of products via online shops across national borders, which is the narrow sense of the current definition of cross-border e-commerce. In fact, the term cross-border e-commerce has been vague for a long period, and the definition of this subject has not been agreed upon internationally until recent years. This new type of trade module is considered to be more complicated, as it is a combination of both international trade and e-commerce. One of the biggest pain points of cross-border e-commerce lies in the integration of information flow,

financial flow, logistics and networking of different borders; any flaw in the integrating process can hinder the smoothness and completion of online business transactions. Further, international trade has to deal with a non-stationary environment and factors such as political environment, foreign exchange, legal norms, tariff, and freight. As cross-border e-commerce is relatively young, regulations of this new business are still stiff in fields such as customs clearance, payment, and taxation.

2.1 Processes and Service Providers of Cross-border E-commerce

Service providers play a critical role as middlemen in charge of the whole process of cross-border e-commerce, including payment, marketing, goods delivery, and even after-sales service. A clear dissection of the process is presented to reveal the importance and role of each part. The International Post Corporation (2017) reported that the logistics industry plays one of the most important roles among the service providers of cross-border e-commerce; it is responsible for both cost-effective and quality services between the platforms and consumers. A sound logistics industry can resolve cumbersome linkages in the process, speed up the delivery of products, and contribute to consumer satisfaction. This clearly identifies the necessity of choosing the right logistics industry, as it heavily impacts the operation of cross-border e-commerce platforms. The competence and capability of a good logistics industry is usually determined by its flexibility, initiative to communicate with customers, and information management. Sheji Ho (2015), who currently owns many logistics operations in Southeast Asia, believes that there are six key elements to the creation of a successful cross-border e-commerce. The elements, named the “6 Ps of cross-border e-commerce,” are processes, platform, product, people, politics, and promotion. This mainly shows the importance of the cross-border e-commerce industry to acquire competent service providers through the six aspects for successful operations abroad. The authors also described how most issues of cross-border e-commerce can be resolved through partnership with the local logistics industry, which can greatly reduce the cost of business operations and help overcome many challenges. Thus, although cross-border e-commerce companies may be able to communicate directly with consumers in terms of merchandise, marketing, trading, etc., regarding localisation, expansion of new market, and the delivery of products in the final step, most of the companies will be in desperate need of trustworthy third-party service providers to manage the distribution overseas and other operational issues. Further, some areas only support cash-on-delivery as a payment method instead of online transactions. In this case, the significance of cooperating with the right service providers is greatly illustrated.

2.2 Types of Cross-border E-commerce

Cross-border e-commerce can be categorised based on transaction objects, trading channels, cargo flow, and customs supervision. If classified according to the difference of transaction objects, cross-border e-commerce can be divided into B2B, B2C, C2C, B2G and several other categories, such as B2B2C, which holds much resemblance to traditional e-commerce. If categorised based on trading channels, cross-border e-commerce can be divided into electronic data interchange and the internet. Based on the direction of cargo flow, there are import cross-border e-commerce and export cross-border e-commerce as categories of cross-border e-commerce. Based on customs supervision, cross-border e-commerce is separated into general cross-border e-commerce and bonded cross-border e-commerce. General cross-border e-commerce is mainly used in regular imports and exports of goods, mostly for small amounts of transactions and quotas, whereas bonded cross-border e-commerce, however, is primarily used in bonded imports and exports in which a large quantity of products goes in and out of bonded warehouses under the customs department. It is easier for online platforms to manage their products through bonded areas, which has proven to be less costly and more convenient. Therefore, the procedures of going through customs clearance and other aspects are significantly different for both cross-border e-commerce and bonded cross-border e-commerce.

In KPMG's ASPAC-E-commerce guidelines (2016), the method used to categorise the types of cross-border e-commerce is according to its operating mode. The guidelines stated that a great portion of the world's current cross-border e-commerce is still composed of small vendors through online platforms and self-run websites. Some individuals choose to open online virtual shops through big cross-border e-commerce platforms that provide them with different distribution channels: direct shipment or bonded warehouses; other individuals who choose to run their own cross-border e-commerce business through self-run sites also have the options of direct shipment or going through bonded warehouses.

2.3 Characteristics and Potential Challenges of the Southeast Asian E-commerce Market

In this section, the current situation, characteristics and potential challenges of the Southeast Asian e-commerce market are discussed, starting with background information on the top six countries in e-commerce in the region: Singapore, Malaysia, Thailand, Vietnam, Philippines and Indonesia. According to Remi (2016) and Ho (2016), the Southeast Asian market is expected to become one of the world's top emerging markets with rapid growth of e-commerce revenues, which is estimated to exceed 25 billion US dollars by the year 2020. It is also expected to climb from the seventh of the world's largest economy to number four by

2030, due to the upcoming reformation of the national tax system towards foreign investors. According to the 2016 report of the "E-Conomy Southeast Asia", the market earned 13 billion US dollars in 2016, which is 2 billion more than the previous year's earnings despite several new-coming foreign acquisitions and market exits. The authoritative company on world economic growth, Frost & Sullivan, is also optimistic about the potential growth of e-commerce in Southeast Asia and recommends investment. More Southeast Asian countries have been actively engaged in the signing of Free Trade Agreements (FTA) and the Comprehensive Economic Partnership Agreement with their neighbouring countries. Most countries in the region have already signed free trade agreements with countries such as China, Japan, Korea, New Zealand, Australia and India; many more are still proceeding. Therefore, it is necessary for Taiwan to bridge the relationship with these countries and have trade agreements. While the e-commerce market in Southeast Asia gradually thrives and blooms, many challenges still lie in its path to prosperity. For starters, the region's geographical fragmentation of islands has made the market itself extremely difficult for foreign cross-border e-commerce platforms to establish a foundation and build a scale; distribution of products is also heavily dented (Meszaros, 2017). Further, the broad range of languages, races, custom regulations and consumer behaviour in these regions is a barrier. In general, the e-commerce industry in the Southeast Asian market faces three main challenges: regulations, delivery, and marketing (Herrod, 2016).

Most countries in Southeast Asia are currently developing a series of laws for their e-commerce business. While some regulations may aid in the protection of e-commerce data and online transactions, some may not be that attractive to foreign investment. Product delivery is one of the major challenges in Southeast Asia, with Singapore having a better distribution mechanism and delivery networks. Tongzon and Nguyen (2013) state that even local postal services are unreliable most of the time in the region, as most local logistics firms are costly or not ready to handle the deliveries of a large quantity of small packages. Online marketing is much trickier in Southeast Asia than in other regions. The differences in languages, traditions and cultures make it hard for the foreign e-commerce industry to establish a scale and fixed market entry. It has proven to be a great challenge to create a platform that suits so many local challenges and cultures while meeting various customs regulations.

Consumer behaviour also varies; their preference explains their shopping pattern and why they may be reluctant to purchase products from certain websites (Pavlou, 2003). This is when a degree of cultural sensitivity is required. Critical cultural insights can help smooth the process of foreign brands' online platform entry and their e-commerce implementations (Lopez and McKevitt, 2017). Only through research and a deep understanding of the local

people's shopping behaviour and routine can a cross-border business be truly successful in Southeast Asia. Although the Southeast Asian market faces many challenges that are not easy to overcome, the potential profit that this market can generate still draws big global cross-border e-commerce players like moth to the flame.

3. Methodology

3.1 Data Source and Survey Design

This study used the framework in Figure 1 to explore the relationship between cross-border e-commerce sustainability and the current characteristics of the cross-border e-commerce industry, addressing some challenges in the Southeast Asian e-commerce market. A total of 36 economic, social, and environmental sustainability factors controlling the characteristics and challenges were identified and used to formulate a survey, the data of which were later used in a grey relational analysis.

The survey was divided into three parts. In Part 1 listed the challenges and factors in the promotion of Taiwanese cross-border e-commerce and sustainability, a total of 36 factors derived from economic sustainability, social sustainability, and environmental sustainability. Respondents evaluated the influence level of these factors on the expansion of Taiwanese cross-border e-commerce in Southeast Asia. Part 2 examined the knowledge degree of the public towards Executive Yuan's New Southbound Policy and how effective people perceive the policy will be on the development of cross-border e-commerce. The final part of the survey captured personal information and an assessment of respondents' general opinions and experiences on the topic. The survey was designed using a five-point Likert scale, in which 1 represents very insignificant (strongly disagree), 2 represents not significant (disagree), 3 stands for neutral, 4 represents significant (agree), and 5 means very significant (strongly agree).

3.2 Grey Relational Analysis (GRA)

Grey relational analysis (GRA), also known as Deng's Grey Incidence Analysis model, was developed and published by Professor Julong Deng in 1979. Concept and information used by GRA should be specific, as they are further categorised into three situations according to the perfectiveness of provided information. Situations with no information are defined as black, and situations with perfect information are considered white. However, these black and white situations are too idealised and seldom occur in real-world situations (Deng, 1982). In the real world, many systems are abstract, unclear, and lack specific mechanisms and prototypes; such situations occur between the black and white extremes and are depicted as grey (Chan and Tong, 2007).

A grey situation is like a blurred and unsure situation, which means that part of the information in this situation is known, while other parts could still remain unknown. As these situations are hard to describe accurately, people can only use logical reasoning, certain ideas and criteria to determine the structural concept of these grey situations, and to express the result with a series of models (Kung and Wen, 2007). Examples of grey situations and systems in the real world are social systems, ecosystems, economic systems, military systems, agricultural systems, and human systems. In general, the behaviour of systems and situations is mostly irregular and hard to predict. The aim and main attempt of GRA is not to find the best solution for the situation, but to supply appropriate ideas and feasible techniques to the forming of a fitting solution for the real world. To determine the connection and influence of elements to the situation (Liu, Yang and Forrest, 2017). Nowadays, GRA is widely used in many fields, such as quality control, engineering, computer science, and performance evaluation.

In this study, GRA was used to evaluate the influence, connection, and impact between the factors. The operation of GRA starts with a small amount of information and uncertain data, and gradually tries to analyse, quantify, and understand the pattern of the relationship from different angles. In conducting the GRA, the first thing is to determine the sequence that features the system. Next, the sequence is regularised before calculating the difference between the referential sequence and the comparative sequence. In this study, a 5 for each of the 36 factors of cross-border e-commerce to sustainability was identified as the referential sequence, whereas results from the survey respondents were denoted as the comparative sequences. After the calculation using the GRA formula, the final result is obtained, called the grey relational coefficient and grey relational grade, which acts as the degree of grey correlation.

To meet the conditions and conduct the GRA, the data must be normalised beforehand. The methods of normalisation can be divided into three: the Larger The Better, the Smaller The Better, and the Nominal The Best.

1. The Larger The Better (LTB)

$$x_i^*(k) = \frac{x_i(k) - \min[x_i(k)]}{\max[x_i(k)] - \min[x_i(k)]} \quad (1)$$

2. The Smaller The Better (STB)

$$x_i^*(k) = \frac{\max[x_i(k)] - x_i(k)}{\max[x_i(k)] - \min[x_i(k)]} \quad (2)$$

3. Nominal The Best (NTB)

$$x_i^*(k) = 1 - \frac{\left| x_i(k) - OB \right|}{\max\{\max[x_i(k)] - OB, OB - \min[x_i(k)]\}} \quad (3)$$

where $x_i^*(k)$ is the value generated by the grey relations.

$\max[x_i(k)]$ is the maximum value in $x_i\ (k)$.

$\min[x_i(k)]$ is the minimum value in $x_i\ (k)$.

OB is the specific value selected as the nominal.

The GRA can be applied to obtain the grey relational grade. The analysis process is as follows:

Step 1. Formation of referential sequence $x_0\ (k)$

$$x_0\ (k) = \{x_0\ (1), x_0\ (2), \ldots\ldots x_0\ (n)\} \quad (4)$$

Step 2. Formation of comparative sequence $x_i\ (k)$

$$x_i\ (\mathrm{k}) = \{x_i\ (1), x_i\ (2), \ldots\ldots \mathrm{x_i}\ (n)\} \quad (5)$$

Step 3. Calculation of Δ_{0i}, $\Delta(\min)$ and $\Delta(\max)$

where $\Delta(\min)$ and $\Delta(\max)$ are the minimum and maximum values of the absolute difference between the parent factor and the sub-factor at all times.

$\Delta_{0i}(k) = \left| x_0(k) - x_i(k) \right|$ is the absolute value of the difference between $x_0(k)$ and $x_i(k)$.

$\Delta_{\max} = \max_{\forall j \in i} . \max_{\forall k} . \Delta_{0i}(k)$ is the maximum difference between the sequences—the biggest $\Delta_{0j}(k)$ of all x_i.

$\Delta_{\min} = \min_{\forall j \in i} . \min_{\forall k} . \Delta_{0i}(k)$ is the minimum difference between the sequences—the smallest $\Delta_{0j}(k)$ of all x_i.

Step 4. Calculation of the grey relational coefficient (Deng, 2003)

$$\gamma(x_0(k), x_i(k)) = \frac{\Delta \min. + \zeta \Delta \max.}{\Delta_{0i}(k) + \zeta \Delta \max.} \quad (6)$$

k = 1,2,3,……, $\mathrm{n} \in \mathrm{N}$, which indicates that there are "n" factors in each of the sequences.

i= 1,2,……,$\mathrm{m} \in \mathrm{N}$, which indicates that there are a total of "m" sequences.

ζ is called the distinguishing coefficient, and the value of ζ is usually $\in [0,1]$;

typically, in GRA, the value of ζ is set to 0.5, but it is adjustable when bigger differences among results are being targeted. However, the alteration of the value ζ will only modify the relative value, which will not affect the sequence and degree of grey correlation.

Step 5. Calculation of the grey relational grade

The calculation of the grey relational grade measures the average grey relational coefficient (Deng, 2003).

$$\gamma(x_0,x_i) = \frac{1}{n}\sum_{k=1}^{n}\gamma(x_0(k),x_i(k)) \quad (7)$$

The grey relational grade can also be categorised into either localised grey relational grade or globalised grey relational grade. Localised grey relational grade involves only the use of a sequence x_0 (k) as the referential sequence, and the rest sequences are all comparative sequences. With globalised grey relational grade, any sequence can be used as a referential sequence. At the end, the results of the grey relational grade indicate the degree of correlation between the sequences. A grey relational grade closer to 1 indicates a higher correlation.

Step 6. Arrange the grey relational ordinal

Lastly, all the sequences are sorted in order of their corresponding grey relational grade; any sequence with a relatively larger value is denoted as a more important factor, otherwise it is less important. This order of arranged sequences is called the grey relational ordinal, which provides the correlation and importance of the factors and key elements.

Taking referential sequence x_0 and two comparative sequences x_i and x_j as example, if $\gamma(x_0,x_i) \geq \gamma(x_0,x_j)$, then the correlation between x_i and x_0 is bigger than the correlation between x_j and x_0, which is indicated as $\gamma_{0i} > \gamma_{0j}$.

4. Results

A total of 418 participants, including 207 Taiwanese and 211 foreign respondents, were surveyed. Responses were collected between 12th May 2017 and 31st May 2017. A total of 433 surveys were handed out. The survey addressed 36 factors of the sustainability of the cross-border e-commerce industry, the New Southbound Policy, and public opinion about the Southeast Asian e-commerce market. The percentage of sampling effectiveness was around 96.54%. The survey respondents were fully aware of the definition of e-commerce and cross-border e-commerce, 100% of the 418 respondents have used and made purchases on domestic e-commerce platforms, 113 (27%) have sold something through the domestic online platform, 296 (70.8%) have made purchases on cross-border e-commerce platforms, such as Amazon, Alibaba, eBay, and the Southeast Asian e-commerce platform Lazada, and 43

(14.53%) respondents have sold products through cross-border e-commerce platforms.

4.1 Calculation of Grey Relational Analysis

According to the *Management Information Crisis* by Daniel (1961), the primary rule for determining an enterprise's sustainability and success is to make a selection of three to six key factors from within the enterprise; otherwise, the outcome is treated as invalid. The author also suggested that the number of selected factors should not bypass half the total number of factors. Therefore, of the 36 factors, the top six with the greatest were selected and discussed in this study.

The survey results were categorised into three parts: economic sustainability, social sustainability, and environmental sustainability. The first part contained 12 factors, the second part consisted of 19 factors, and the third part consisted of 5 factors. A total of 400 surveys were collected and analysed according to the criteria of Daniel (1961), and GRA was conducted to determine the most important factors for the sustainability of cross-border e-commerce. However, survey results from both Taiwanese respondents and foreign respondents were analysed separately for comparison in the later part of the study. The final data from the 207 Taiwanese respondents were used as the main reference, while data from the foreign respondents served as supporting numbers.

Prior to GRA, the survey results were calculated using the method of the Larger the Better for a more evident outcome. The factor with the largest number of grey relational grades was identified as the most correlated factor, which had the largest significance towards the sustainability of cross-border e-commerce; the factor with the lowest grey relational grade was considered the least influential.

The survey data were entered into an Excel form for a clearer inspection before the application of GRA. Respondents 1 to 207 were listed in the vertical axis, whereas factors 1 to 36 were lined up in the horizontal axis, categorised into three parts: economic, social, and environmental.

4.2 Environmental Sustainability Factors of Foreign Respondents

The results of environmental sustainability factors from the foreign respondents ranged from 0.5995 to 0.6603. Three clusters were evident in the data. The factors are designated as C1 to C5. The top three among the five factors in the category of environmental sustainability factors were eco-friendliness from Cluster 1 (C1, 0.6603), green packaging from Cluster 1 (C2, 0.6534), and geographical fragmentation from Cluster 2 (C3, 0.6341). As shown in Figure 2, eco-friendliness was the most critical element for sustainability in this category, although green packaging was almost as significant. In this case, the cluster composition was

slightly different compared to the outcome of the Taiwanese respondents in which eco-friendliness was in Cluster 1, whereas 2nd and 3rd place green packaging and geographical fragmentation belonged to Cluster 2.

4.3 Comparison of Taiwanese and Foreign Respondents

Table 1 displays a comparison of the six most critical factors of cross-border e-commerce sustainability as indicated by the responses of Taiwanese and foreign respondents.

Table 1 Comparison of the top six key factors

Nationality	Ranking	Category	Factors	Grade
Taiwanese respondents	1	Social sustainability	Ease of use	0.7581
	2	Economic sustainability	Partnership	0.7336
	3	Social sustainability	Culture and language	0.7247
	4	Economic sustainability	Logistics cost	0.7211
	5	Economic sustainability	Warehouse	0.7173
	6	Social sustainability	Cybersecurity	0.7121
Foreign respondents	1	Economic sustainability	Logistics cost	0.7651
	2	Social sustainability	Brand image	0.7523
	3	Social sustainability	Ease of use	0.7367
	4	Economic sustainability	Partnership	0.7322
	5	Social sustainability	Culture and language	0.7187
	6	Economic sustainability	Warehouse	0.7136

Based on the results of analysis of the 211 foreign respondents, logistics cost was the most crucial factor of the sustainability of cross-border e-commerce, although it ranked number 4 according to most Taiwanese. Surprisingly, brand image was listed as the second most important factor by foreigners, whereas Taiwanese respondents did not really value this factor, ranking it 22nd. Ease of use, partnership, culture and language, and warehouse were important key factors to both Taiwanese and foreigners, being ranked among the top six factors, although slightly differently by both groups. The 6th important factor to Taiwanese respondents, cybersecurity, was ranked by most foreigners as the11th of the 36 factors. Another similarity between both Taiwanese and foreign respondents was that they both had three economic sustainability factors and three social sustainability factors as the top six crucial factors; neither group perceived the environmental sustainability factors as important.

The following table shows a comparison of the top three key factors in the category of economic sustainability, as ranked by Taiwanese and foreign respondents. Partnership was the most important factor to the Taiwanese in this category, whereas most foreigners selected

logistics cost as the most significant factor. However, the influence of warehouse was equally perceived by both parties, as it was listed as number three by both groups.

Table 2 Comparison of the three key factors of economic sustainability

Economic sustainability			
Nationality	**Ranking**	**Factors**	**Grade**
Taiwanese respondents	1	Partnership	0.7336
	2	Logistics cost	0.7211
	3	Warehouse	0.7173
Foreign respondents	1	Logistics cost	0.7651
	2	Partnership	0.7322
	3	Warehouse	0.7136

A comparison of the top five key factors ranked by Taiwanese and foreign respondents showed ease of use which was ranked first place by Taiwanese was ranked this factor second place by foreigners. Again, both parties had culture and language at the 2nd and 3rd place, respectively. While Taiwanese respondents tended to attach more value to the importance of cybersecurity and aftersales service, foreign respondents went for brand image and consumer behaviour. For most foreign respondents, brand image was one of the most crucial factors for enterprises to achieve success, as brand image is often equated with the reputation, prestige, and face of a company. However, most Taiwanese respondents did not recognise its importance, ranking it 22nd place, which means that they did not really agree about its influence on the topic of cross-border e-commerce. This may be related to the cultural differences between the East and the West and their business operating concept. However, the key factor efficiency showed up similarly in the 4th and 5th place by Taiwanese and foreigners, respectively.

Table 3 Comparison of the five key factors of social sustainability

Social sustainability			
Nationality	**Ranking**	**Factors**	**Grade**
Taiwanese respondents	1	Ease of use	0.7581
	2	Culture and language	0.7247
	3	Cybersecurity	0.7121
	4	Efficiency	0.7012
	5	After sales service	0.6869
Foreign respondents	1	Brand image	0.7523
	2	Ease of use	0.7367
	3	Culture and language	0.7187
	4	Consumer behaviour	0.6998
	5	Efficiency	0.6977

Lastly, the comparison of the responses in the environmental sustainability category showed that both Taiwanese respondents and foreign respondents agreed on eco-friendliness as the most important key factor, followed by green packaging and geographical fragmentation.

Table 4 Comparison of the three key factors of environmental sustainability

Environmental Sustainability			
Nationality	**Ranking**	**Factors**	**Grade**
Taiwanese respondents	1	Eco-friendliness	0.6634
	2	Green packaging	0.6345
	3	Geographical fragmentation	0.6330
Foreign respondents	1	Eco-friendliness	0.6603
	2	Green packaging	0.6534
	3	Geographical fragmentation	0.6341

The results of the GRA comparing the Taiwanese respondents and foreign respondents revealed that, although there are some differences in the rankings of key factors, the selected top six from both parties had many similarities. The outcome from both the Taiwanese respondents and foreign respondents were essentially the same in the overall ranking of the top six key factors despite the small differences in the sequence. The biggest distinction was in the ranking of the factor brand image, which stood out against the others. This not only highlights the significance of branding in the eyes of the Westerners, but also identifies the differences in the attitudes and ways of company operations between the East and the West.

Further, the results of identified key factors from both Taiwanese and foreign parties still

showed high correlation towards each other even when inspected separately in three regards: the determined three key factors were the same despite the ranking in the category of economic sustainability; the differential factors in the category of social sustainability were cybersecurity, after sales service, brand image, consumer behaviour, and the ranking; in the case of environmental sustainability, both the identified key factors and the ranking were the same. In other words, the matching of the two outcomes has also provided the study with a high degree of credibility on the final determination of the top six key factors that control the sustainability of cross-border e-commerce. The results from the Taiwanese respondents are discussed below.

5. Discussion and Conclusion

Based on the analysis of the study of the key factors of cross-border e-commerce and its sustainability, four characteristics defined the study: 1) The core of this study was not only about successful expansion of cross-border e-commerce in alien markets but also its sustainability. The factors selected were related to the business' sustainability and were later categorised into economic, social and environmental for more effective evaluation. 2) All the survey respondents possessed knowledge of the topic of the study, and 100% of the respondents had experience in the purchase of products through online platforms. Some have conducted cross-border transactions and sold goods. 3) The survey respondents were divided into two categories of Taiwanese and foreigners and analysed separately for the purpose of comparison. Although the respondents were of different cultures and languages, the results of the top six key factors from both Taiwanese and foreign respondents were similar, which enhanced the credibility and trustworthiness of the analysed results and the study itself. 4) The study provided the top six key factors for the business based on GRA and identified the important ones in each category. The rankings of key factors from the analysis of the foreign respondents can also be used as a reference for Taiwanese cross-border e-commerce companies who may be looking for foreign partners, providing them with better heads-up about factors that these new partners might consider important.

5.1 Recommendations to Cross-Border E-Commerce Companies

The number of consumers, market size, and future potential in Taiwan are very limited, and it has become inevitable for e-commerce businesses to go abroad and develop cross-border services. Thus, the study identified the top six most important factors for cross-border e-commerce to achieve success: ease of use, partnership, culture and language, logistics cost, warehouse, and cybersecurity. Therefore, the development strategy of Taiwanese cross-border e-commerce companies should be formed in consideration of these

elements in pursuit of better outcomes.

The advantages of Taiwanese cross-border e-commerce in comparison to other countries were logistics flow, finance flow and informational flow, whereas the disadvantages included labour cost, innovation and environmental sustainability. There are both good and bad aspects of these characteristics in combination with the six most crucial factors. It is encouraging that none of the three disadvantages of the current situation of Taiwanese cross-border e-commerce fit into the identified crucial factors; the labour cost disadvantage will be replaced once the trade expansion reaches Southeast Asia and new local employees are adopted. It is concerning that none of the advantages of the current situation of Taiwanese cross-border e-commerce seems to fit into the six crucial factors. Therefore, we aligned these crucial factors with the New Southbound Policy and Productivity 4.0 in pursuit of more practical and implementable recommendations and development strategies for Taiwanese cross-border e-commerce companies.

5.1.1 New Southbound Policy

As the Taiwanese government hopes to establish a win-win cooperation model and an economic community awareness through the new Southbound Policy with Southeast Asian countries, the New Southbound Policy is expected by the Executive Yuan to strengthen the relationship between Taiwan and these countries through four aspects: economic cooperation, talent exchange, resources sharing, and region linking.

(1) Economic Cooperation

a. Setting up Taiwan Desk: The action of setting up Taiwan Desk in Southeast Asia as the window for Taiwanese investors in the regions to communicate with each other and create group clusters can greatly aid in the aspect of partnership. This window can assist businessmen in the collection of local resources and the development of bilateral trade opportunities.

b. Recommendation (partnership): Windows set up for communication should not be limited to Taiwanese investors only, but also open to credible local investors and even other foreign businesses. Windows like this can easily aid in the discovery of new friends and potential partnerships for Taiwanese cross-border e-commerce companies abroad and provide them with great support.

(2) Talent exchange

a. Personnel training: The aspect of talent exchange in the New Southbound Policy will come with the greatest help in overcoming culture and language barriers. The government is now focusing on the training of Southeast Asian language skills in Taiwan and cooperating with industries to establish classes on the studying of

"Southeast Asian knowledge," which will support potential Taiwanese who are capable of speaking the local language and understanding the customs and culture in the Southeast Asian regions.

b. Recommendation (culture and language): Scholarships and bonuses can also be offered to the students as a kind of incentive and to certified persons who are willing to work in Southeast Asia, as these talents will become a valuable asset during the expansion of cross-border e-commerce and respond rapidly to solve the barrier of culture and language between the companies and the locals.

(3) Resource sharing

a. Culture promotion: In terms of resource sharing, the government has decided to dedicate itself to the promotion of Taiwanese culture through Taiwanese films, TV dramas, literature, and online games, which can also help resolve the culture and language barrier between nations. In other words, these promotions will market Taiwanese culture as a brand to Southeast Asia and may as well gain recognition from local consumers.

b. Recommendation (culture and language): More activities on the sharing of cultural insights and experiences should be co-hosted by the government and cross-border e-commerce companies, such as the selling of Taiwanese films, books, magazines and games through these online platforms. However, these opportunities should be earned and promoted by the cross-border e-commerce companies themselves and in an active fashion.

(4) Regions linking

a. Strategic Alliances: The core of regions linking in the New Southbound Policy is to conduct regional integration through the signing of trade agreements with partners in Southeast Asia or cooperating in economic projects. Region linking can be viewed as a kind of guarantee of local partnership from the government to Taiwanese cross-border e-commerce companies. The government has promised to help cross-border e-commerce companies reach agreement on at least 20 bilateral cooperation cases and to form strategic alliances on market entry with at least 30 foreign manufacturers.

b. Recommendation (Partnership): To strengthen the propaganda on the New Southbound Policy to improve the participation of local e-commerce enterprises and to demonstrate its resolution in the facilitation of partnerships through real actions. Through quantitative broadcasting and life examples, the odds of attracting proper partnerships will definitely increase.

Through the four aspects of the New Southbound Policy, the development strategy of

Taiwanese cross-border e-commerce on partnership, culture and language, logistics cost and warehouse has reached the initial steps of formation. The development strategy will be further integrated with Productivity 4.0 in pursuit of a more comprehensive resolution.

5.1.2 Productivity 4.0

Taiwan's Executive Yuan has also launched its own Productivity 4.0 programme in response to the emerging trend. Productivity 4.0 aims to optimise domestic factories and improve supply chains, focusing on the promotion of new manufacturers and integrating related technologies. The Taiwanese government will also be drafting new regulations that are beneficial to the manufacturing industry. In this case, the upcoming Productivity 4.0 could be either a future threat or an opportunity for Taiwan's e-commerce industry. Cross-border e-commerce platforms in Taiwan are mostly based on B2C models, and there have not been many online windows for the exporting of machines and tools from Taiwan to the world. For example, the quality and design of Taiwanese tools has been ranked number four in the world, but due to the lack of flexible online platforms for these products, difficulties are encountered in the way of introducing them into the higher-end markets for more profitable outcomes. Therefore, the government has decided to establish new online platforms to market these tools and other products related to the manufacturing industry. Existing cross-border e-commerce companies should seize this opportunity and offer their experiences and consultancy. Such assistance will not only include them in Productivity 4.0 and the field of manufacturing but will also actuate new partnership opportunities and consumers.

As the number of working population has been on the drop since 2015, another emphasis of Productivity 4.0 is to develop intelligent robots that could be put to use in factories as a new workforce. Intelligent robots are not required to have the form of a human and possess all body parts; for example, a working robotic arm and robotic hooks are considered intelligent robots. Most of these intelligent robots are still under development, and the government has been looking for available volunteer factories or warehouses to test the robots once completed. Therefore, Taiwanese cross-border e-commerce companies that have already acquired warehouses and logistics partners in Southeast Asia should not overlook this juncture but actively seek the opportunity to have these intelligent robots tested in their facilities, as the existence of these intelligent robots will undoubtedly boost their efficiency and help reduce costs in both logistics and labour.

The application of the internet of Things (IOT) will allow network connectivity to collect and exchange data among these objects. The Taiwanese government has also proposed that some Southeast Asian countries introduce the IOT into their factories due to the promised collaboration on economic and regional support through several treaties in 2016 and 2017.

Therefore, Taiwanese cross-border e-commerce companies should actively partner with credible third-party payment companies and cybersecurity firms, informing and preparing them for the upcoming introduction of IoT, as the right use of IoT in cross-border e-commerce can greatly enlarge the profit and help enhance the cybersecurity of cross-border e-commerce.

5.2 Conclusion

The identified six factors, including ease of use and cybersecurity, will definitely play a big role and influence the expansion of Taiwanese cross-border e-commerce to the Southeast Asian market. As partnership, logistics cost, and warehouse greatly influence cross-border e-commerce in the dimension of economic sustainability, ease of use, culture and language, and cybersecurity heavily impact the business in social sustainability. Therefore, these factors should always be deeply considered and addressed during a company's foreign operation in Southeast Asia. Additionally, although none of the environmental factors was identified as one of the top six key factors, this dimension should not be overlooked, as eco-friendliness has gradually become the world's trend and many of the businesses have moved to become more green. Given that there were only five factors from the environmental category in comparison to twelve in economic and nineteen in social factors of sustainability, the number of environmental factors influencing cross-border e-commerce is estimated to increase in the future. Therefore, it is also recommended that future studies should further investigate the category as it relates to the sustainability of the business.

However, there are limitations that must be considered, as cross-border e-commerce is broad, especially in the part that involves bilateral and multilateral trade agreements or tariff barriers with other countries. In this case, factors to the successful cross-border e-commerce actions and future sustainability could easily vary or have substantial change within a short period due to the timely adjustment of these regulations. Furthermore, the amount invested by most Taiwanese e-commerce businesses in Southeast Asian markets is still comparatively low compared to other countries, such as China, the United States, and Japan. Some of these Taiwanese e-commerce businesses are still in the process of planning, proposing, and market evaluation, without any real action in the foreign market yet. Therefore, practical and real-time data on the performance of Taiwanese e-commerce business in Southeast Asia will be extremely difficult to seek and make use of. Due to the uncertainty of trends, future development, and the fast-changing nature of cross-border e-commerce, future studies on this topic should include representative real-life cases as examples and use a larger cohort of respondents with repeated analyses. Furthermore, it is also recommended that future studies include not just the B2C models in cross-border e-commerce but also other models, such as

B2C2C, O2O, and import-oriented cases.

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Is Agro-Technovation Input/Output the Central of Business Performance? An Exploratory for Creating Competitive Advantage of Vietnamese Large Firms

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Abstract

Agro-processing enterprises play a significant role in the contribution of Vietnamese economic power. To gain competitive advantage on the foreign market, it is essential to be aware of the performance-competition relationship which helps firms improve their business and respond quickly to market changes. Different studies explore the business performance in different ways, but most of which focus on parameters of the market sales, or development of new/improved products. From the adaption of the iceberg model and 'philosophy' of agro-technovation performance, we implemented input-output-performance analysis by employing a qualitative case-study approach in four large manufacturing exporters. The findings showed that input-output transformation occurs continuously mutually and determines indirectly to form the competitive advantage of firms on the international market. Moreover, by assigning each case to one of four positions, the matrix of agro-technovation performance and competitiveness as an analytical tool was established, helping managers allocate resources and capital to develop business strategy toward the sustainable competitive path. Theoretical and practical implications are discussed and presented.

Keywords: *output, input, performance, competitiveness, agro-technovation, Vietnam*

1. Introduction

An agro-manufacturer just achieves competitive advantage once it enables unlocking the most engaging sustainable benefit, for target customers, and delivering it in a way that no other business could. A competitive advantage may stem from the user experience - or it may be another tangible or intangible asset, such as the intellectual property or the customer service team. Besides, from point of view of Barney (1991) and Clulow et al. (2003): “A firm is said to have a competitive advantage when it is implementing a value creating strategy not simultaneously being implemented by any current or potential player". Therefore, business competencies of an entrepreneur refer to ability gained at a superior level of performance than their competitors (Christensen and Fahey 1984; Jüttner and Wehrli 1994) which needs to be analyzed at multiple aspects.

Competitive advantage separates surviving businesses with thriving ones, but the source of competitive advantage can change from firm to firm, sector to sector. In case of agro-industry, each manufacturer establishes its own performance. A Successful innovation process implemented will raise a firm to position of superior performance (Passemard and Calantone 2000) by facilitating the agro-manufactures with competitive capacity in a technology-rich environment. In this study, we identify attributes and resources establishing agro-technovation performance to distinguish competitive agro-manufacturers with surviving ones. Our study provides empirical evidence about the agro-technovation management process as well as about sources of competitive advantage. By focusing on the administrative mindset of invisible innovative sources, agro-technovation inputs are put as a central role that helps to improve performance of Vietnamese agro-manufacturers.

2. Literature Review

2.1 Iceberg Model and “Philosophy” of Agro-technovation Performance

Many studies on the innovation-performance relationship have been carried out to aim to improve firm productivity when new technologies and innovation management need to be investigated. Several measures of agro-technovation performance indicators have been widely adopted in different innovation output. Popularly, innovation rate (number of new products) (Lau & Lo, 2019; Tsai, 2001) is measured in terms of the number of commercialized new products expressed as the percentages of all products in the company over the last three years. The novelty of new products (Wang & Ahmed, 2004) or value-added rate of new products (Jiao, Ma, and Tseng 2003) were also applied to evaluate agro-technovation performance. Financial indices show whether the innovation has had an impact on the market or has been financially successfully. Take for example, sales performance or sales growth rates constitute

the dimension of a firm's market advantage. It shows whether the innovation has had market impact or been financially successful (Lau and Lo 2019). Sales performance (Guan & Ma, 2003; Wan et al., 2012; Yam et al., 2004) is considered as a indicator as the amount of sales due to technologically new/improved products as a percentage of total sales over the last 3 years.

However, evaluating firm performance like relatively individual performance is a process to evaluate systematically efficiently capacity of staff, which includes work results (outputs) and working methods, qualities and skills (inputs). As the same way, agro-technovation outputs are visible and agro-technovation inputs are invisible. As consequences, like an iceberg, the visible portion that we can see above the waterline is very small compared to the whole. When we see an iceberg, the majority of agro-technovation lays beneath the surface. Most of us often think that we can examine all aspect of innovation from external surface such as range of goods/services, new product speed, product profitability, and market share. In fact, there are many innovative components that are invisible and lie below surface. Addition, in case firm performance is bad, this lead to a challenge to trace the cause of problems or find broken links.

To support above idea, Antonio, 2019 propose that the key to increasing innovation performance is through the efficiency with which the innovation process is undertaken (Liao & Wu, 2010; Wang & Han, 2011). Moreover, the dedication of more inputs to the innovation process does not guarantee innovation outcomes, since the process of developing innovation is complex and characterized by high risks (Wolff 2007). Thus, identification and prioritization of strategic planning innovation_ what firms need to be able to manage technology for strategic competitive advantage? The firm's innovation behavior of commitments to identify strengths, weaknesses, opportunities and threats, formulate plans in accordance with corporate vision and missions, and acclimatize the plans to implementation achievement of strategic objectives (Richards and Yang 2010).

2.2 Agro-technovation Performance, Creation Competitive Advantage

The efficiency and capabilities derived from technovation can be beneficial to the firm and lead to enhanced competitiveness (Guan & Ma, 2002; Yam et al., 2011). A promotion in product developments is attributable to the accumulation of capabilities and contributes to innovation outputs. Evangelista et al. (1997), thus, regarded R&D activities as a central component of firms' agro-technovation activities and as the most important intangible form of innovation expenditure. A firm's heterogeneous resource portfolios are responsible for the variability observed in its financial returns. These are the firm's specific innovation that contributes substantially to its sales growth and competitive advantage.

Competitive environment is reflected both on the demand side, where consumers demand high quality and low prices, and on the supply side, where firms face local competitors along with international rivals (López Rodríguez and García Rodríguez 2005). In this way, firms that dedicate part of their efforts to markets abroad have intensified their search for competitive advantages (Hitt et al. 1997), in order to confront the competition and act in international markets. Similarly, Zou & Stan (1998) and Tamayo Gallego et al. (2015) supposed that competitiveness could be attributed to three factors: internal-controllable, internal-uncontrollable, external-uncontrollable. However, based on the business-behavior, the single most important set of determinants falls in the cell of internal-controllable factors. The prevalence of controllable factors suggests that export competence is under the control of the firm and its innovation and management (Zou and Stan 1998).

3. Methodology

3.1 Identification and Selection of Case-studies

Applying the case selection procedure proposed by Eisenhardt (1989), the case studies were selected for several theoretical reasons. We carried out a multiple case study of the agro-technovation process implemented by agro-manufacturer 1 (AM2), agro-manufacturer 2 (AM2), agro-manufacturer 3 (AM3), agro-manufacturer 4 (AM4). The decision to focus on the four firms mentioned above was based on the fact that all of them are leaders in their respective fields (Stake, 1995). Qualitative sampling strategies aim to identify reasonable instances of the (larger) phenomenon under research (Flick, 2018). Purposeful sample is selected, while at the same time reducing the likelihood that the way a sample is chosen influences the outcome of the research (Easterby-Smith et al., 2015). Significant changes of these firms will be observed in various dimensions employed include: (1) They are representative of sub-sector in agro-industry with success business; (2) Their attitudes toward innovation in all areas of farming, processing, and commercializing; and (3) Their attitudes to apply and manage technology by adapting and quickly responding to consumer needs, or even creating new specific needs.

3.2 Data Collection

Case studies typically combine data collection methods such as archives, interviews, questionnaires, and observations. The evidence may be qualitative (e.g., words), quantitative (e.g., numbers), or both. Based on 983 agro-processing firms' profile on stock finance market recoded on January, 2020, the procedure of data collection was adapted from three-step logic of Dominguez & Mayrhofer (2017). First, we identified, through three data-bases (Vietstock, Ministry of Industry and Trade, General Department of Vietnam Customs), independent

agro-manufacturing exporters located in the Vietnam with high-light business activities. This first step led us to identify 85 agro-processors corresponding to the profile. Second, we conducted an exploratory study to test our interview guide and to select firms for in-depth case-studies. A focus group is administrated under an open interview with 2 managers of agro-processing, 2 industrial consultants, and 2 public-sector agencies of promoting who accompany these firms. We selected these four agro-manufacturers for their critical nature, as they represent information-rich cases to illuminate the questions under study (Patton 2002; Voss, Tsikriktsis, and Frohlich 2002). Third, we implement procedures of 'data trajectory' collection on four case-studies. In the data collection phase, we used various sources of evidence to identify the resources and technovation.

4. Findings and Discussions

Under the within-case analysis, we explore that there are two groups (competitive and uncompetitive) which can be characterized by innovation performance such as new product development, export ratio, strategic planning, and R&D/advanced technology investment.

4.1 Competitive Cases

NPD is vital to business growth, even agro-business as it demonstrates the firm's agro-technovation and its response to the diverse market needs. AM1 and AM2 are considered as manufacturers have sustainable competitiveness because number of their new products increase gradually over years with range from crop seeds (rice, corn, and vegetables), agricultural products (flowers, strawberry, melon, and packaged rice), confectionary products, nuts, aquaculture to fruits and beverage. AM1 kept growth of NPD at a high level, especially the period 2013-2014 (Figure 1) with outstanding efforts of AM1's member companies on seed varieties. In addition, both AM1 and AM2 are pioneers of applying technology and science in production of fruits, vegetables and flowers qualified for advanced standards.

Farming (fish nurseries/crop seed) is one of the important factors that directly affect the quality of agro-products. AM1 applied hi-tech farming, automatic machines and the environment protection from strategy to action. AM1 is constantly studying to develop fish nurseries which are healthy, disease-free and suitable to farming conditions in Vietnam. The current major of R&D activities in aquaculture/plantation are as follows disease control, efficient aquaculture/plantation solutions, and development of value-added products. Because Vietnamese fruits can be exported through a quota to China, AM2 must be competitive in purchasing raw materials with many traders and competitors who did not invest in growing areas. This pushes AM2 in potential risk of breaking planning and production plans.

Seriously, fake seeds on the market are labeled AM2's brand causing a loss of reputation and directly affecting the efficiency of production and business of famers and AM2.

Competitive cases have focused on developing the closed sustainable value chain (from researching, selecting quality breeds - farming systems, production - post-harvest technologies - to foreign trade). Instead of beginning in the agriculture sector primarily, AM1 develops its agro-food business through M&A strategy. For example, establishing a seed company, in order to have good breeds, requires investment in R&D, along with forming a highly skilled workforce, with laboratories and the field model and the distribution system which last several years. Therefore, through M&A deals, AM1 has owned well-branded companies, good human resources, and a large market. For AM2' strategy, it pursues the ambition of turning passion fruit and baby jackfruit into Vietnam's pride as Kiwi of New Zealand. AM2 is the first company to have a passion fruit seed institute, providing disease-free passion fruit varieties throughout Vietnam according to from Taiwan. AM2 has cooperated with local administrations and cooperatives to build materials areas of 45,000 ha of fruits.

4.2 Uncompetitive Cases

Figure 1 shows that growth of new products of AM3 and AM4 is nearly unchanged over a period of 7 years. They offer customers is very low and not increasing. Without new products results in both of them losing ground in the market in the future. Over 40 years, AM3 just focused on producing 2 main lines of products: (1) latex (ice cream); (2) latex block. Block latex products used to make car tires accounts for 66% and ice-cream latex used for cushioning, gloves accounts for 32%. The deeply processed export accounts for a very low rate. It means products of an uncompetitive-case group are sold to the world market without brands or through foreign brands. Similarly, AM4 has just stopped processing coffee under forms of semi-washed bean and unwashed bean. We acknowledge that thanks to great natural resources, export output of both AM3 and AM4 is at the volume top among Vietnam's agro-enterprises. Although, in 2008, AM3 started diversifying their products by producing mattresses and pillows from its available raw materials and developing new products is a good step to increase profits, AM3's these new products are poor in ideas, designs and supplement services.

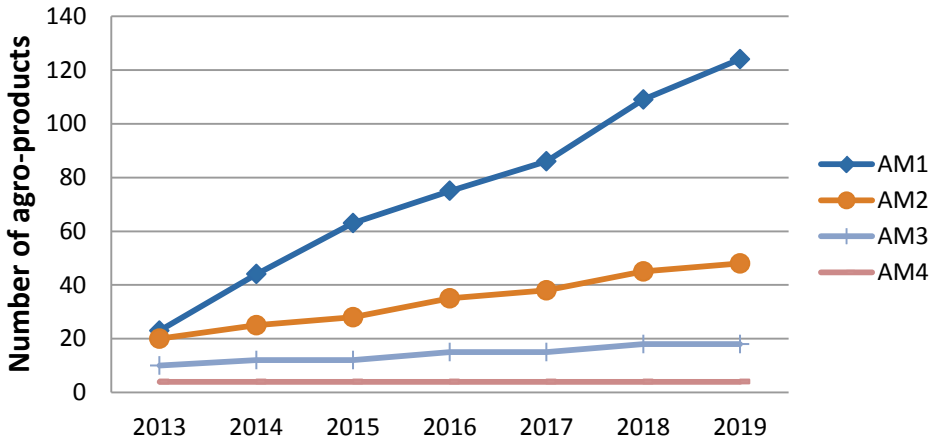

Figure 1 Growth of new agro-products of 4 study-cases over recent years

AM3's process innovation performs better than AM4's. With modern high technology and the production line of Malaysia and Germany, AM3 has manufactured the products of mattress, latex pillow from 100% natural rubber. In addition, the quality of mattresses and pillows are certified by Malaysian agencies. With the innovation process, AM3 has become the partner of many domestic and foreign companies such as Michelin, Saficalcan (France), Mitsubishi (Japan), CJ, Tea-Young (South Korea). AM3's export turnover reaches 150,000 USD per year. For AM4's process, farmers as workers are voluntarily contracted with firms to sell their coffee in their capacity from 15 to 20 years. However, this contracting process is not effective with the un-specific conditions of each form of contracts and each contracted household made conflicts of benefits between AM4 and farmers. Moreover, the size of households' land decides the investment costs, which indirectly affects the productivity of coffee tree, so, in terms of raw material inputs, AM4 is passive than others. The newest processing system of AM4 was installed in 2009, reaching a capacity of about 40,000 tons of coffee beans per year. However, machines for farming are still in shortage and backward. This leads to coffee humidity being too high which gets easily moldy due to drying and preserving techniques. Once one of the linkages of value chain is broken, performance becomes worse and worse.

Both AM3 and AM4 reveal signs of their poor agro-technovation strategy. AM3 and AM4 tell us that they do not pay attention to their rivals and just do it their traditional way. They always attempt to oversimplify process of strategic planning. This mean lack of market awareness, not knowing the main factors of competition in foreign markets often give firms the false belief that they are the best in somehow superior, even when competitors always change, more innovative and being market leader. Over several years, AM4 struggle with frustrated equity owners, attorneys, and staff who have no idea of the direction AM4 is going. Having nothing concrete to work toward, important decisions tend to favor expedience and short-term profit. Thus, in 2015 after 10 years of pilot, AM4 intercrop durian and avocado

trees into coffee gardens to create shade for coffee trees and bring contemporary economic efficiency to farmers. It can be seen that the both AM3 and AM4 have stopped at in-depth research on seed varieties, land and land use planning, while R&D and technology on product quality and NPD has not been paid attention. Awareness role of harvesting, deep processing, preserving, marketing and trading is missed, which lead to low competitiveness in the international market.

By assigning each study-case to one of four categories (Figure 2), we found that correlative relationship between agro-technovation performance and competition exist. This helps the firms allocate resources and is uses as an analytical tool in agro-technovation process management, strategic management, product management. Through APC matrix, we could analyze aspects of the matrix corresponding to the vertical and horizontal axes that are: (1) agro-technovation performance: product diversity (new products), innovation process, strategy planning; (2) competition on market: competition is high or low. Each of the four quadrants represents a specific combination of agro-technovation performance, and competitiveness:

- *Good performance, high competitiveness*. Firms are managing the agro-technovation process efficiently. They also have high significant competitiveness in the present and future.
- *Bad performance, high competitiveness*. Firms are troubled in the innovation process, but considered as high competitiveness due to excellent strategy. They absolutely have the opportunity to improve their position on the matrix.
- *Good performance, low competitiveness*. At this position, most firms have not invested in NPD, even in the innovation process. Good performance seems to be contemporary. In the long term, they will be pushed to the lowest level of the matrix.
- *Bad performance, low competitiveness*. Absolutely, these firms of this cell are unaware of agro-technovation and competitiveness.

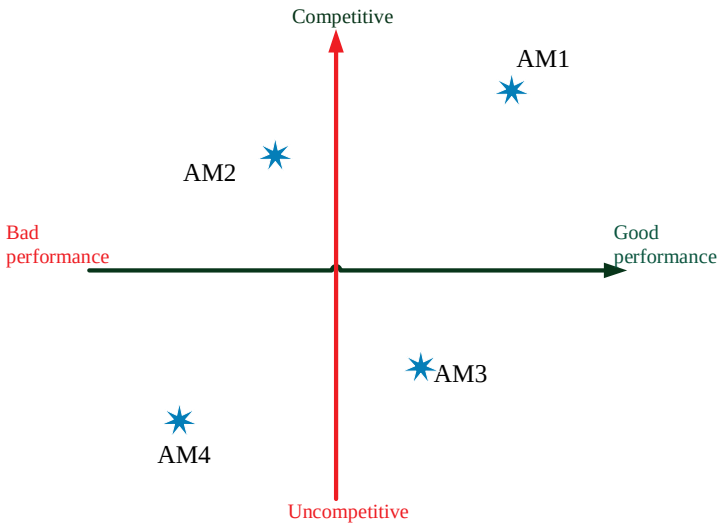

Figure 2 Matrix of agro-technovation performance and competitiveness (APC)

Actually, APC modeling is not a new phenomenon, but in the changing digital landscape of agro-industry, its application to agro-innovation strategy will continue to develop. To apply the APC matrix, think of it as a sustainable managerial approach, so it tends to be more relevant to larger agro-businesses with multiple technovation. The key to success on international market is using data-driven decisions to increase agro-technovation transform from input to output. However, managers in smaller businesses can use similar portfolio thinking to their supply chain to boost leads and competition. The APC model is seen as simplistic and it can be difficult to classify agro-technovation in smaller businesses where the relative competition is too week to quantify. It's also based on the concept that competitiveness can be achieved by spending more on the R&D budget.

The purpose of this study was to explore agro-innovation process management to the establish of competitive advantage and the four studies cases show three key indicators developed by firms' APM in establishing competitiveness, based on the definitions of literatures (Tsai et al., 2001) through the influence on agro-technovation performance toward to a sustainable development. The analyzed cases reveal particularities related to APM of four study-cases. In the case of AM1, NPD represent for the accumulation of agro-technovation capabilities or technovation increase which contributes to firm performance as supported by Lau and Lo (2019). At case of AM2, only one broken link of technovation systems influence strickly on firm performance, even investment management and strategy planning become more efficient toward sustainable competitiveness. The technological interrelatedness between various sub-systems or sub-processes is featured by the ability of the actors to generate, diffuse, and utilize innovations that have economic value, collectively known as the firm's technovation, as recommended by Carlsson et al. (2002). This is also similar to case of AM3. In all cases, the strategic management of the institutions triggers technological capability development, affecting on agro-technovation performance, as supported by Song et al. (2011). It means strategic innovation planning is a prerequisite for successful business and achieving a competitive advantage. Thus, in case of AM4, it says that it has a not good strategy but actually they do not. AM4' strategy ignores the power of choice and convergence, attempting instead to accommodate a number of conflicting internal demands and interests. All of all, we build an integration model that helps the firms allocate resources and is used as an analytical tool in relation to agro-technovation performance and competitiveness.

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Estimation of Vegetation Using NDVI for Several Factors in Steppe Region, Northeast of Mongolia

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Abstract

The vegetation is the most important factor of the biomass. It is also an important factor in cropland suitability and agriculture. In this paper, we aim to study vegetation, which related to several factors in steppe region. The study area is located in the northeast of Mongolia. The satellite data NDVI is commonly used for vegetation.

In this study, we use the Normalized Difference Vegetation Index (NDVI) which depended on Land Surface Temperature (LST), The Normalized Difference Water Index (NDWI) from MODIS satellite data and Elevation, Slope from ASTER GDEM satellite data. This research focuses on two machine learning methods: Multiple linear and Random forest regression.

We used MODIS and ASTER GDEM satellite data's from 2001 to 2010 (July to August). The analysis was performed in Python Jupyter Notebook and ArcGIS. The result of both proposed models was compared with MODIS NDVI value. The validation results of these two methods are 71 and 91, respectively.

Keywords: *satellite data, vegetation index, regression method*

1. Introduction

The Mongolian territory is landlocked and surrounded by high mountains in the north and southwest, and located in the transition zone between the great Siberian taiga and the Central Asian desert, which belongs to the central parts of the Eurasian continent[1]. Almost fifty percent of the whole area is steppe and grassland, which is mostly located east part of Mongolia. Grasslands are globally some of the most converted and least protected of natural community types [2]. The east part of Mongolia is following two terrestrial ecoregions: the Mongolia-Manchurian grasslands, and the Daurian forest-steppe. While these ecoregions extend into China and Russia, generally the grasslands in Mongolia are much less degraded than the grasslands in the two neighboring countries[3],[4].

According to the zonal vegetation classification, the upper and north part of the river basin is a mountain forest zone and the eastern part of the river basin belongs to the dry steppe zone. For the vegetation geographic classification, the river basin belongs to the northeast Mongol Daguur and north of the Eastern Mongolian steppe [6].

In recent years, vegetation yields are declining in the steppes. For this reason, the aim is to study vegetation for several factors: Normalized Difference Vegetation Index, The Normalized Difference Water Index, Land Surface Temperature satellite data from MODIS and Elevation, Slope from ASTER GDEM.

In this study, we used two regression methods: multi-linear regression(MLR) and random forest regression (RFR) method in our research. Both regression methods are included in the paper and results are compared.

2. Study Area

The study area is Dashbalbar soum of Dornod province which is located in the north-eastern part of Mongolia. Geographically, it is 650-700 m above sea level and belongs to the Khentii suburban mountainous region on the west side. The total area of Dashbalbar soum is 8834 thousand squares kilometers. Almost 96 percent of the entire area is pasture land.

Harsh winter and cool summer, in January average temperature -30.3C in July average temperature + 26.0C, average annual wind speed 4-5m / s and total of annual precipitation 264-300 mm.

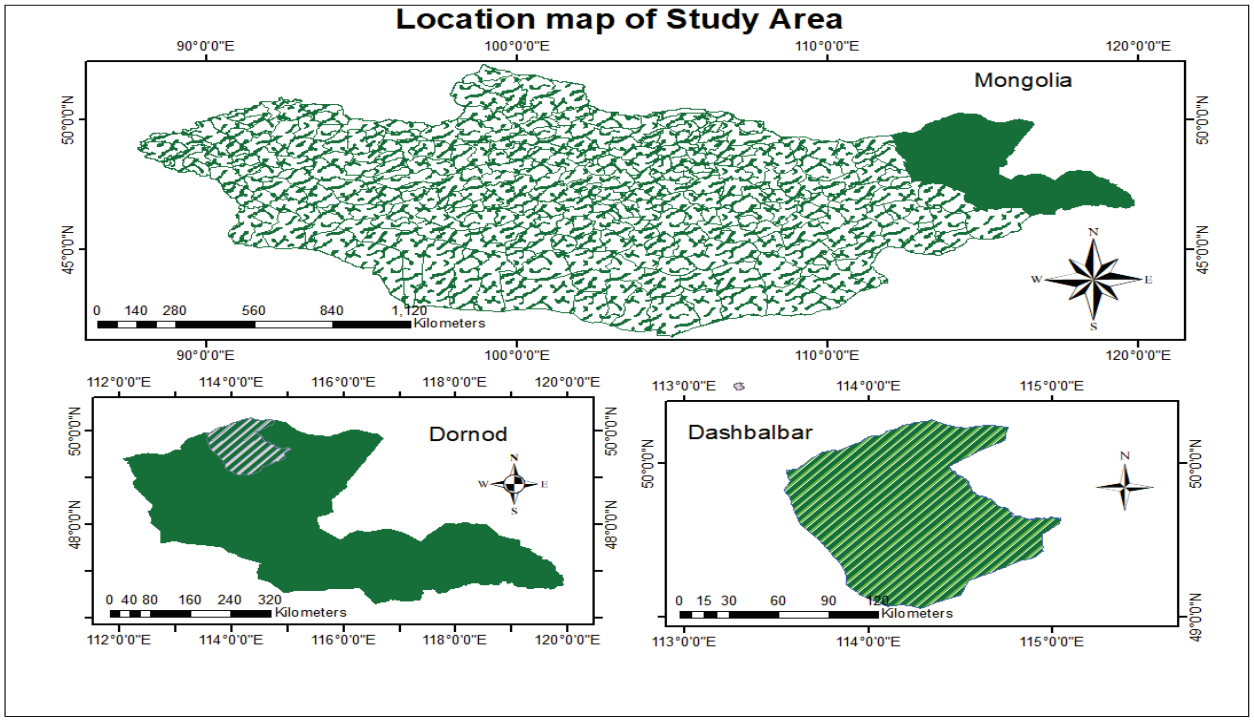


Figure 1 Study area: Dashbalbar soum, Dornod province, north-east Mongolia

3. Data

In this research, we used MODIS Terra and ASTER GDEM data from remote sensing satellite images. MODIS data are described in Table 1. Moderate Resolution Imaging Spectroradiometer (MODIS) is a sensor operating on the Terra and Aqua satellites, which were launched by NASA in December 1999 and May 2002, respectively.

Table 1 Spatial and temporal resolution of the MODIS products

MODIS product code	MODIS product name	Spatial resolution (m)	Temporal resolution (days)	Number of images
MYD13A1v006	NDVI	*500*	*16*	*14*
MOD09A1v006	NDWI	*500*	*8*	*25*
MOD11A2v006	LST	*1000*	*8*	*25*

MODIS vegetation indices usually produced on 16-day intervals from 500-meter spatial resolution in common.

We calculated Normalized Difference Water Index (NDWI) using equation 1. In here near-infrared (NIR) and short-wave infrared(SWIR) from MODIS Terra MOD09A1v006.

$$NDWI = \frac{NIR-SWIR}{NIR+SWIR} \quad (1)$$

Finally, we used MODIS satellite data MOD11A2, which MODIS LST (land surface

temperature) with 1000 m resolution, bundled for 8 days from 2001-2010.

Also, we used data sets from ASTER (Advanced Spaceborne Thermal Emission and Reflection Radiometer) GDEM (Global Digital Elevation Model) satellite datasets and it is the elevation and the slope. [7].

4. Methodology

The general structure of our model is given by the following equation:

$$NDVI = F(NDWI, LST, Elevation, Slope) \quad (2)$$

In this paper, we used two kinds of regression methods: Multiple Linear Regression (MLR) and Random Forest Regression (RFR). These both methods are a statistical technique that uses several (two or more) explanatory variables to predict the outcome (or function, or model) of a response variable

The goal of MLR is to model the linear relationship between the explanatory (independent) variables and response (dependent) variables. The formula for Multiple Linear Regression model is defined by the following equations:

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + + \beta_n x_n + \varepsilon \quad (3)$$

Where: y - response (dependent) variable.

$x_1 x_2 \ldots, x_n$ -explanatory (independent) variables

$\beta_0, \beta_1, \beta_2 \ldots, \beta_n$ -slope coefficients for each explanatory variable

ε -the model's error term (also known as residuals)andour linear regression form is:

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \boldsymbol{\varepsilon}$$

where: y -Normalized Difference Vegetation Index (NDVI), x_1 -Normalized Difference Water Index(NDWI),x_2 -Land Surface Temperature (LST),x_3 -Elevation and x_4 -Slope.

The result of the multiple linear regression, model for crop vegetation as follows:

$$\text{NDVI} = 0.9622\ \text{NDWI} - 0.00288\ \text{LST} - 0.0013\text{Slope} + 0.6563 \quad (4)$$

Random Forest Regression (RFR) is a supervised learning algorithm that uses an ensemble learning method for regression. The ensemble learning method is a technique that combines predictions from multiple learning algorithms to make more accurate predictions than a single model.

Random forest builds multiple decision trees and merges them together to get a more accurate and stable prediction. It has nearly the same hyperparameters as a decision tree or a bagging classifier.

5. Analysis

We analysed a model with multiple linear regression in Python. The result was R^2= 0.71 from the regression analysis (Table 2).

Table 2 Result of regression model from our developed model

OLS Regression Results						
Dep. Variable	NDVI		R-squared			0.71
Model	OLS		Adj.R-squared			0.69
Method	Least Squares		F-statistic			3075
	coefficient	standard error	t	P>/t/	[0.025	0.975]
NDWI	0.9622	0.070	5.029	0.000	0.785	1.053
LST	-0.00288	0.0001	-2.183	0.000	-0.005	0.009
Elevation	-2.178e-05	5.62e-05	-0.201	0.000	0.000	7.09e-05
Slope	-0.0013	0.0001	-1.369	0.047	-0.003	0.002

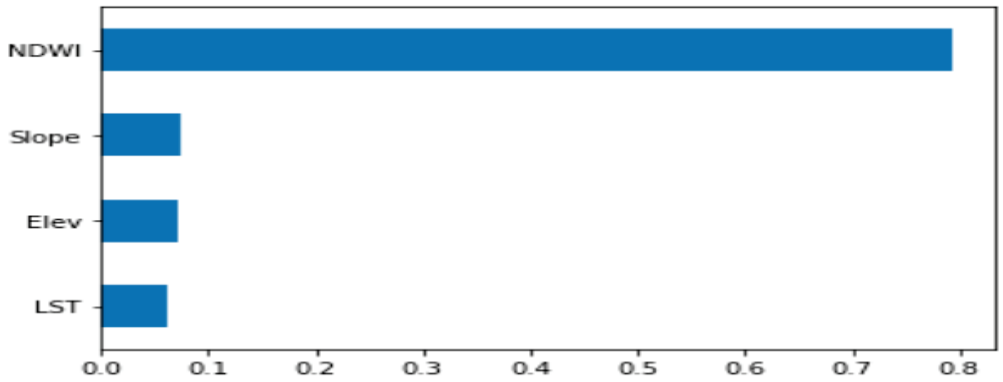


Figure 2 Feature importance using Random forest in based on NDVI with rest of data

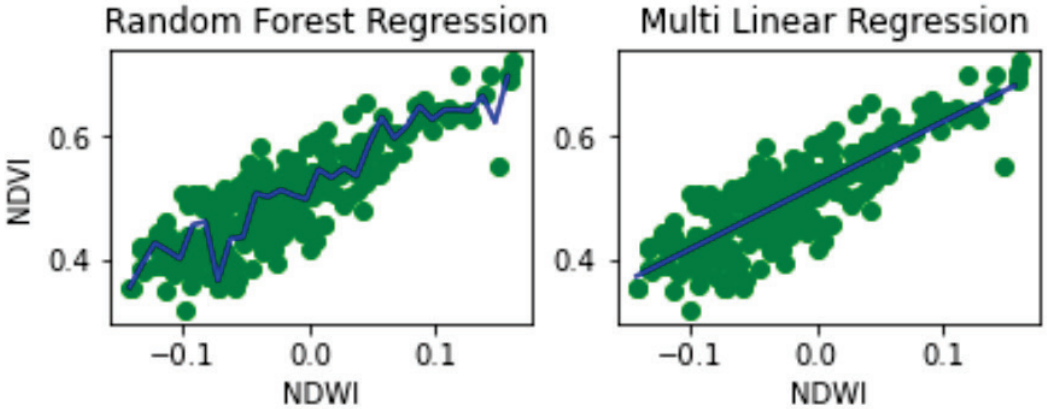


Figure 3 The comparisonon NDVI with NDWI using RFR and MLR

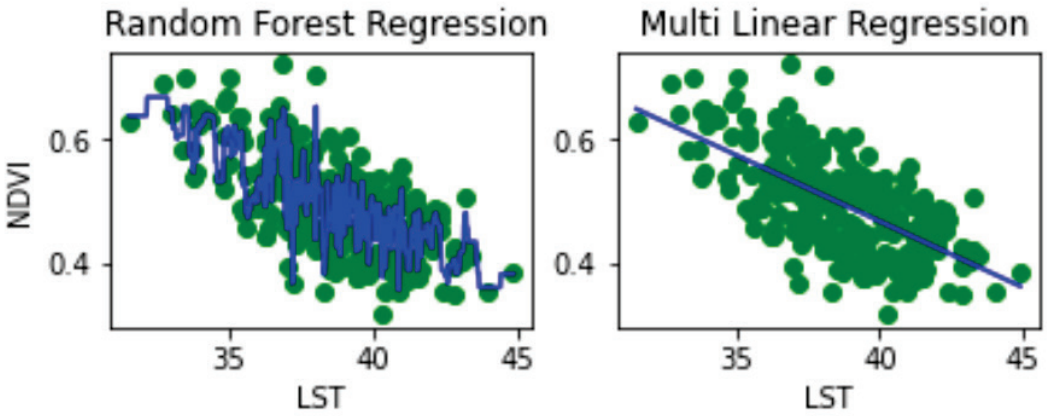
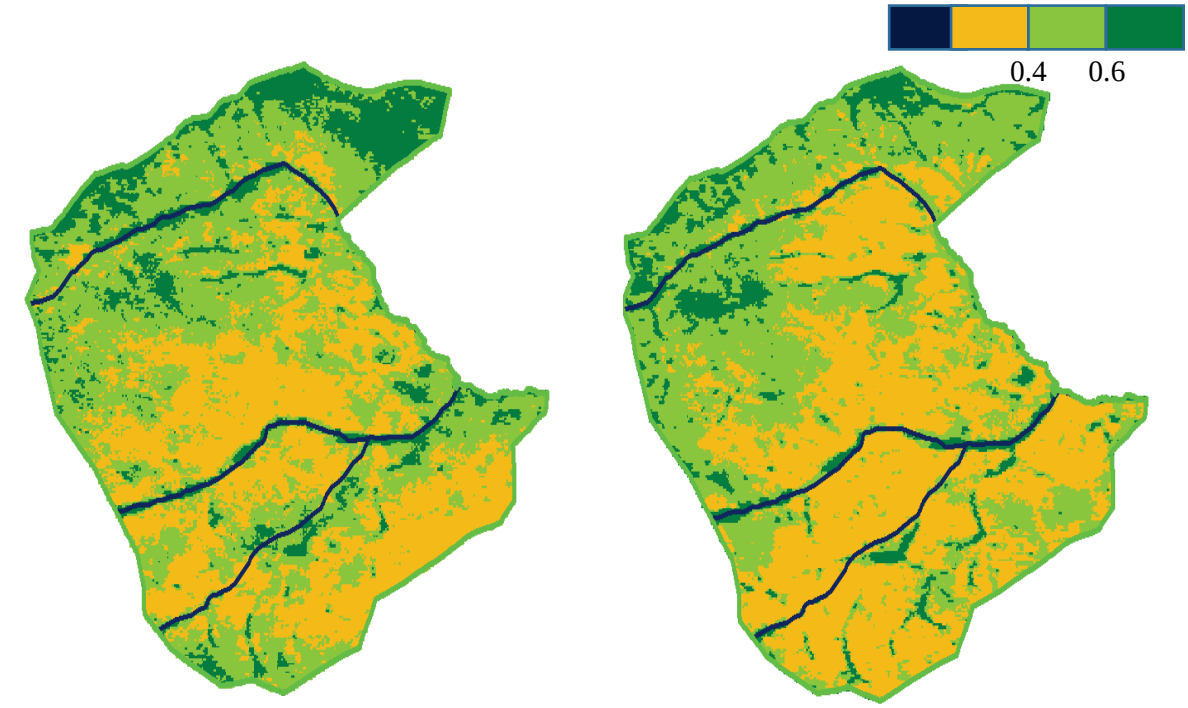


Figure 4 The comparison NDVI with LST using RFR and MLR

Figure 5 Validations of the random forest and multiple linear regressions



Average result July between in 2001-2010 Average result in August between in 2001-2010

Figure 6 The vegetation map from the results

6. Results and Conclusion

Table 3 Result of comparison random forest and multiple linear regressions

Model	R-Square	Mean absolute error	Mean squared error	Score
Multiple linear regression	71.3	0.032	0.00156	0.71
Random forest regression	94.6	0.035	0.0019	0.84

Random forest regression is an ensemble method, not linear. The result is shown by table 3, validation of the random forest regressions much higher than multiple linear regression.

Using Random forest, an important feature based on NDVI is NDWI (Figure 2). Also, NDWI is a highly positively correlated NDVI (Figure 3).

The second important feature is Slope (Figure 2), it concludes that our study area is located belong to the Khentii suburban mountainous region. Elevation and Slope had very little effect. The land surface temperature (LST) has a less important feature by Random forest regression. It looks that, LSTis a highly negative correlated NDVI (Figure 4). Validation of two regression methods is shown Figure 5.

The result is shown by equation (4), in which we classified the NDVI maps (Figure 6) from our developed models. As shown in the map, west, north-west and north region of the study area has more vegetation, the model is close to the ground truth.

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Drone in Agriculture Supply Chain: An Insight

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Abstract

Towards the new era, an unmanned aerial vehicle (UAVs), known as a drone, plays an essential role in every aspect of daily human life, particularly in the sustainable agriculture supply chain. In sustainable agriculture, drones play a role in optimising agriculture operations, crop production, and crop growth monitoring. The trends in using drone technology helping agriculture experts lead the way with sustainable farming methods while also protecting and boosting revenue in precision farming. In Malaysia, the usage of drones in agriculture has created a new job creation and opportunity for the youngster to serve in their village as well as helping their parents at the farms, instead of working in the city. Therefore, this research aims to provide an overview of the drone applications in Malaysia's sustainable agriculture supply chain. It is hoped that this study offers an insight for the industry players and researchers to discover the transformation of drones in sustainable agriculture.

Keywords: *Drone, UAVs, Agri Supply Chain, Sustainable agriculture, Innovation*

1. Introduction

The adoption of drones in agriculture is not new in global farming. Drones are increasingly being used in agriculture as part of an effective approach to sustainable agricultural management that allows agronomists, agricultural engineers, and farmers to help streamline their operations and gain practical insights into their crops using robust data analytics. The crop monitoring, for example, is simplified by the use of drone data to precisely plan and implement continuous adjustments, such as ditch placement and fertiliser application changes. Instead of more conventional time and labour-intensive data collecting, products may be reliably traced from farm to fork utilising GPS coordinates for every step along the route.

2. Malaysia Agriculture

In Malaysia, the agriculture sector plays an important role in the Malaysian economy, and it contributes more than 1.6 million people for employment (Dardak, 2015). It contributed 7.1 per cent, which is equivalent to RM101.5 billion to the Gross Domestic Product (GDP) during 2019. The main contributor was oil palm, which ad value to the agriculture sector at 37.7 per cent and followed by other agriculture (25.9%), livestock (15.3%), fishing (12%), forestry and logging (6.3%) and rubber (3%) (Department of Statistics Malaysia, 2020).

2.1 National Key Economic Areas (NKEA)

Moreover, in the National Key Economic Areas (NKEA), agriculture is one of the vital areas among the 12 areas: education, tourism, wholesale and retail, electrical and electronics, healthcare, palm oil, financial services, and others. NKEA for agriculture aims to transform the agriculture industry, which emphasises agri-business. The existence of the NKEA program is to ensure economic development in Malaysia (Wikipedia, 2021).

2.2 Industrial Revolution (IR 4.0)

Other than NKEA, the industrial revolution (IR 4.0) also play a significant role in contributing to the economic growth in Malaysia. IR 4.0, which mainly focuses on technology, has been introduced in the manufacturing sector and has boosted the country's productivity. At first, the aim was that only the manufacturing sector had expanded to another industry such as services and agriculture. Towards the IR4.0, the agriculture field has started to use technology for planting to harvesting (Khoirunisa & Kurniawati, 2019). IR 4.0, introduced in agriculture, hastened the agriculture sector to transform the Malaysian economy and increase productivity. Mat Lazim et al., (2020) have listed the enabling technologies for adopting IR 4.0 in table 1. In his research, he stated that in the agriculture sector, IoT and

sensors are the major enabling technologies which identify that can improve smart farming operations likewise yield monitoring, diagnosing insects pests, measuring soil moisture, analysing harvest time, and monitoring crop health status. The IR 4.0 can use mobile devices to remotely manage all agricultural sensors in a field (Mat Lazim et al., 2020).

Table 1 Pillar of enabling technologies for the adoption of IR4.0

No.	Pillar	Description
1.	Additive manufacturing	Producing a product from new materials using 3D printing technology. For example, producing artificial bone from composite materials.
2.	Artificial intelligence (AI)	Application of machine learning to develop computer programs that can train actuator/robot to perform a duty as described by programmer. AI technology can be used to build a smart plant factory, in which data from supply chains, design teams, production lines and quality control are linked to form a highly integrated and intelligent systems.
3.	Big data analytics (BDA)	Analysis of data collected by sensors and observe the trend of the data to make real-time decision. BDA can be applied to improve product quality, energy efficiency and perform predictive maintenance.
4.	Advanced materials	Development of new materials and nano-structures components with better durability and strength. For example, material with good shape retention and thermoelectric efficiency.
5.	Cybersecurity	The communication level in many industries is becoming complex and strongly connected. Thus, digital security becomes a critical aspect to protect any online system from being hacked by outsiders.
6.	Simulation	Simulation is applied by engineers to predict the product behaviour under different conditions. In a field, simulation in used to predict crop yield due to different agronomical practices and varied climatic condition. Simulation is performed to find the optimal way to produce a crop.
7.	Cloud computing	With the availability of cloud computing system, small companies can access cloud service on rental basis to leverage cloud-based product design, simulation, AI and big data solutions to improve their production.
8.	Augmented reality	Augmented reality can be used to deliver part replacement instructions to maintenance staff in the field.
9.	Internet of things (IoT)	IoT is the platform which connect different sensors at one time. IoT can be combined AI and big data to develop autonomous systems which can transform crop production.
10.	Autonomous robots	Autonomous robots such as drone or unmanned tractor can perform their jobs based on the prescribed order programmed to them. Autonomous robot can think, act and react autonomously similar to common human movements.
11.	System integration	System integration is created to share the data and information amongst the industry players. The system exists within the industry value chain and also across multiple value chains.

2.3 National Agrofood Policy (NAP 2.0)

Previously, the Third National Agriculture Policy (DPN3) has been enduring by introducing Malaysia Agrofood Policy 2011-2020 and 2021-2030(Ministry of Agriculture and Food Industries, 2021). From the NAP 1.0 policy, the key is to enhance the food value chains and increase the growth of food production in Malaysia (Norasma et al., 2019). For NAP 2.0, the focus is more towards evaluating global and domestics challenges of food supply. Moreover, the main focus of NAP 2.0 such as follows:

i. Securing the country food supply
ii. Strengthening technology applications in agrofood sector in line with the Fourth Industrial Revolution (4IR);
iii. Ensuring that agrofood sector is sustainable and in line with the country commitment in achieving Sustainable Development Goals (SDGs); and
iv. Developing the high value agriculture commodities as a new source of wealth to the country (Ministry of Agriculture and Food Industries, 2021).

3. Challenges in Malaysia Agriculture

Tambi and Dardak (2020) had identified the significant challenges in Malaysia agriculture, such as the following:

1. Crop yields are dependent on unpredictable weather conditions. For example, climate change has shifted (the fruiting seasons and affected the production of agricultural produce.
2. Natural calamities such as floods and long droughts have led to harvest loss, thereby adversely affecting agricultural infrastructure.
3. The majority of farmers are now aged around 60 years old. They are less educated and refuse to adopt new technologies. At the same time, young people do not want to take over the family farm holding because they tried to find better opportunities in other sectors (Tambi & Dardak, 2020).

Therefore, due to issue number three mentioned above, we can see that the best solution will be using technology to reduce the burden among the farmer. Indeed, the idea or notion of using technology is also supported by Tambi & Dardak (2020), claiming that the above issues need technology-driven solutions. Certainly, both authors stated that adoption and adaptation technology as solutions come from the Internet of things (IoT), Data-driven, GPS, cloud computing, robotics, automation, in-filed drones are crucial (Tambi & Dardak, 2020). Hence, this study deemed it important to see an overview of UAV in agriculture as a solution to attract the youngster to take over their family farm. Due to the above challenges, the drone applications will be elaborate further.

4. Applications of Drone

A UAV (Unmanned Airborne Vehicle) could be a flying gadget that can fly a pre-set course with the assistance of autopilot and GPS facilitates. Moreover, the device has typical radio controls; it can be guided physically in case of blame or perilous circumstance (Ahirwar et al., 2019).

Drone applications are worldwide in the military, delivery services, security and law enforcement, search and rescue, films and television industries, and agriculture (Ahirwar et al., 2019). Another area will be in the field of precision agriculture, forestry (Jaafar et al., 2018) construction, and survey, disaster and humanitarian relief, anti-poaching, security and surveillance and education (Ab Rahman et al., 2019).

Globally, drones in agriculture are commonly used for various purposes such as crop monitoring, soil assessment, review of plant population, irrigation and drainage, fertility and crop, protection, spraying of fertiliser and pesticides and harvest planning (Pinguet, 2021). The use of drone technology also plays a crucial role during natural disasters such as floods and benefits the farmers in crossing the damaged through the terrains that may not be reached by foot.

The use of UAV can get accurate data in the field whereby it can recognise technology that can produce high spatial resolution imagery (1< 1m) and suitable temporal frequency for quick reactions in the creation of relevant crop and field status information (Elarab et al., 2015 and Norasma et al., 2019). Moreover, UAV may take photos of the farmer's crop using a range of camera filters, allowing for multiple spectrum imaging, image processing, and analysis, all of which provides greater information on the health of the farmer's crop while also indicating parts of the crop that require special care.

While the small UAV can be effectively flown and kept up with small preparation, making it an awesome choice for farmers looking to progress their cultivating by consolidating horticulture with the technology innovation of remote sensing (Cano et al., 2017)

In Malaysia, the Civil Aviation Authority of Malaysia (CAAM) emphasise all Unmanned Aircraft System (UAS) or known as drone flight activities, are bound under Civil Aviation Regulation 2016 (MCAR) Regulation 140-144. Thus, for agriculture UAS operations for the aim of :

- Dispensing any agricultural any agricultural payload intended for plan nourishment, soil treatment, propagation of plant life, or pest control; or
- Engaging in dispensing ‘agricultural payload’ and surveillance activities directly affecting agriculture, horticulture, or forest preservation, but not including the dispensing of live insects (Civil Aviation Authority of Malaysia, 2021).

Palms oil is suitable in tropical areas, including Malaysia. It is crucial to obtain information about the palm oil trees that can be planted through forecasting the yield, monitoring the growth of oil palm, enhancing their productivity (Li et al., 2017) and automated airborne pest monitoring using thermal cameras, identification and counting of specific insects from very high-resolution optical images, development of decision support system (DSS) using geo-referenced images as a basis for a GIS-based system giving oil palm growers the possibility to incorporate data directly to their precision farming platforms, identification and mapping of Ganoderma disease using a hyperspectral camera, automated retrieving of oil palm canopy chlorophyll and nutrient content from multispectral and hyperspectral UAV acquired images, and dynamic Web mapping and inventory management of oil palm productivity using in situ sensors (Ruano et al., 2018).

Indeed, the world greatest vegetable oil consumption which is about 35 per cent, come from palm oil, unlike other oil crops such as soybean and sunflower. Due to the increasing demand for palm oil, most plantation fields changed to palm oil plantations (Norasma et al., 2019). Besides, proper daily management of oil palm is needed in planting operations like weeding, pruning, harvesting and manuring (Chong et al., 2017). Therefore, using UAV, it can capture geospatial orthophotos that examine the growth of oil palm starting from planting and determine whether areas of the plantation are suitable for agricultural planting (Norasma et al., 2019). The existing system had developed to notice the palm oil nutrient stress, and images from UAVs need to identify the oil palm rods (Guldogan et al., 2017; Moranduzzo & Melgani, 2014). From the orthophoto, the user can coordinate with other maps that have agriculture components. Images captured by UAV were examined to see the oil palm plantation growth (Fahmi et al., 2018).

In rice crop, the study by Norasma et al., (2018) at Kelantan found that multirotor UAV and RBG imagery usage in rice monitoring can reduce foreign labour dependency, workers exposed to toxic chemical content can be minimized, easy access to the difficult areas, reduce the machinery risk damaged during the field observation, and cost-effective high-resolution image can be provided. So far, the result from the findings showed that it is advisable to observe the condition of the rice at each stage of the growth (Norasma et al., 2018).

Another study by Marzuki et al., (2021) stated that drone seeding employs gravity drop to spread the seed. However, the disadvantage of this approach is that the seed remains over the ground and are uncovered to different dangers such as climate conditions and creatures. Rain can wash the seed away from its intended planting place, and the seeds are also vulnerable to animals. Seed capsules can shield seeds from external threats and increase their survival rate. Seed may be shot from the drone into the ground to ensure the predetermined planting spot. Seeds dropped by gravity may have a sticky outer coating to keep them in place

until planted. The seed kind, size, form, and weight, to some extent, would be a problem in creating the seed firing mechanism. Its weight influences the carrying capacity of a drone. These elements can aid in seed establishment on the earth (Marzuki et al., 2021).

Khoirunisa and Kurniawati (2019) stated in their study case in Sungai Besar, Selangor, that the adoption of machines and technology-based for most agricultural activities has been implemented. In this area, the farmers form their cooperatives, namely Wawasan Tani. They have six pilots that can operate drones to apply pesticides or fertilisers to plants. With the use of Spraying Drone, DJI types can spray about 10-litre pesticides. With three times the rechargeable battery capacity, it can cater to almost 60 times pour. In which one-time battery charge, it can spray up to 20 times. Results of their study through observation found that using drones is more effective and efficient. The activity of spray pesticides to the plant and the frequency of processing time can be from two to five times faster. Moreover, the drone can determine the current plant health and pest and diseases. With the use of the drone, not all areas need to be spray, and we can choose a particular size that needs to be spray pesticide due to damage or disease (Khoirunisa & Kurniawati, 2019).

5. Conclusion

Drone usage is widely used in various sectors like agriculture, construction site, health, and others. It gives more benefits to the farmers than the conventional method, which may reduce operation time at the plantation field. Therefore, the drone is important in the agriculture sector to increase agriculture productivity, which contributes to the country's economy.

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The Literature Review of Environment, Social, and Governance

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Abstract

Current sustainable investment, especially in the context of the capital market, is better known as ESG (environment, social, governance) investment. The investment of firms with ESG orientation is increasing rapidly. Driven by the increased public, government, and consumer attention to the broader impact of companies, and by investors and executives who recognize that strong ESG can sustain a company's long-term success. The attention from stakeholders to companies who have a sustainable ESG has drawn many researchers to conduct studies to improve the qualities of ESG itself and tell the importance of why companies should apply it to their business. Various studies have also found that companies that pay attention to ESG aspects correlate with higher equity returns. The previous study has proved that ESG has greatly impacted the company's image in society, bringing ESG a lot of attention and interest. This review also discusses a previous study of ESG Investing in Indonesia. This paper intends to discuss the importance of sustainable investment and the prospects of ESG.

Keywords: *ESG, ESG Investing, Sustainable Investment, Investment Strategy*

1. Introduction

Corporate governance was defined as a design of relationship structures and procedures used by company parts (Board of Directors, Board of Commissioners) to provide added value and mutual benefit to shareholders on an continuing foundation in the long term while taking into account the interests of other stakeholders, plus complying with procedures internal and applicable laws and regulations (OECD, 2015). Good Corporate Governance (GCG) is defined as a form and process that regulates the pattern of harmonious relationships between the roles of company organs and other stakeholders (Soebyakto et al., 2017). Good Corporate Governance can also be explained as a set of regulations that control the relationship between shareholders, company management, government, employees, and all stakeholders regarding their rights and obligations (Ntim, 2017).

GCG also means a check and balance mechanism that includes balancing authority over company control by building signs to avoid mismanagement, including misuse of company assets to take advantage of business opportunities. GCG is a crucial factor in measuring the level of success of the company. The discourse on GCG is always followed by integrated risk management and compliance.

Many studies have talk about the effect of good corporate governance on company performance, but in recent years, a new trend has emerged, where investors consider environmental, social, and corporate governance factors by using the Environmental, Social, and Governance (ESG) score (Saddek Syafrullah, 2017).

At this time, the term ESG is increasingly popular. Not only is it a trend, but now it has also become a long-term financial decision. Responsible business management is associated with the issue of ESG. Companies must pay more attention to social and environmental responsibilities to gain legitimacy for the social role and environmental care that the company carried out to gain the trust and support of the community. The trust and support obtained from the community can positively impact the survival of the company in the future (Gray, et al., 1995).

In practice, the environmental context is related to how the company manages energy, waste management and expenditure, the resources needed, and the environmental impact on living things. The environmental aspect also includes carbon emissions, noise pollution, and climate change.

Meanwhile, in the social aspect, it includes the relationship and reputation of the company to the community and institutions. The social aspect also includes issues of diversity and inclusion as the company works in a wider and various society. In governance, the implementation systems, controls, and procedures applied by the company to regulate operations, make essential decisions, follow the law, and connect the needs of external

stakeholders are also a concern in the context of ESG (Koller and Nuttall, 2019).

The investment of companies in the world with an ESG orientation is currently increasing very rapidly. Driven by the increased public, government, and consumer attention to the wider impact of companies, and by investors and executives who recognize that strong ESG can sustain a company's long-term success. Various studies have also found that companies that pay attention to ESG aspects correlate with higher equity returns.

Lee, et al (2013) discussed the company's performance in companies with a high ESG score and companies with a low ESG score. They took a sample of American companies based on the ESG score on Sustainable Asset Management (SAM) from 1998 to 2007 using the CAPM model. They also pointed out the differences between companies with high and low ESG scores in terms of size, book-to-market, and momentum. They also identified that market risk as a determinant factor of the difference.

1.1 Sustainable Investment

The number of stakeholders interested in the company's sustainable development is increasing. In general, ESG investment strategies or sustainable investments fall into two broad categories. The first is responsible investing, an investment that avoids negative impacts on the environment and society (do not harm). The second is an investment that also aims to have a positive impact on the environment and society (do good) or impact investing (Jones and Bedel, 2021).

Sustainable investment takes into account environmental, social and corporate governance aspects, in addition to financial factors of course. Sustainable investment is an ethical investment that employs both socially responsible investment (SRI) and ESG investment procedures (Abdelsalam et al., 2020). Sustainable investment has the potential to impact sustainable development by coordinating social, environmental, long-term governance, and monetary issues criteria during investment decisions (Tseng et al., 2019).

Governments and non-governmental companies (NGOs) have so far not done enough with their efforts to answer undeniable global problems such as climate change, poverty, and inequality. Thus, sustainable investment has proven to be a key emulsion to environmental and social summons by making non financial or financial markets more and more responsible for ESG effects (Talan and Sharma, 2019).

In general, the use of sustainable investments affects society, the green environment, and a company’s economic performance. This implies that investors should have a screening method in selecting investment targets under the lens of a company's ESG performance. The result is that in the case of an ethical retirement plan the risk-adjusted return that invests in an SRI-enabled organization receives the same financial benefits as the old-fashioned retirement

plan. The implication is that companies in the stock market centre on green investments that enable SRI enhancements resulting in improved technical expediency, cost-effectiveness, and performance levels with the same financial returns (Abdelsalam et al., 2020). The value of sustainable investments affects society, the green environment, and the economic performance of companies. This implies that investors must have a showing method in selecting investment targets under the insight of a company's ESG performance.

1.2 Investment Strategy

One of the investment strategies that has been discussed is exclusionary. Exclusionary, also known as negative screening, is quite simple, and was the earliest used by investors but is still quite dominant today. Exclusionary excludes or screens out companies or investment objects whose businesses are considered to harm the environment or society. Businesses that are considered environmentally and socially negative are usually cigarettes, coal, weapons of mass destruction, gambling, and others (Jones and Bedel, 2021). Investors can also define themselves how they screen companies that are considered to have negative social and environmental impacts.

The other strategy is called ESG integration which is the fastest-growing strategy in recent times. As the name implies, in this strategy investors or investment managers “integrate” various environmental, social, and governance factors when they analyze a company. Analysts or investment managers will analyze the ESG aspects of a company, and then make adjustments before making investment decisions. High ESG risk will potentially reduce sales and/or increase costs, so sales and profit forecasts must be adjusted. This risk may not be accurately reflected by adjusting sales or cost forecasts. In this situation, an adjustment is usually made to the valuation (Vezér et al., 2017).

Align investments with organizational values or for further philanthropic purposes. Mission-related investments are often aimed at producing a measurable positive social or environmental impact. Often interchanged with "impact investing". Impact investing is less attentive on returns and more absorbed on goal or purpose. With investments, investors invest in market divisions dedicated to answer tension problems around the world and impact those problems. These sectors can include those making progress in green and renewable energy, housing equity, healthcare access and affordability, and more (Grim and Berkowitz, 2018).

2. Stakeholder and Legitimacy Theory

The idea of corporate social responsibility has been developed since the early 1970s, which is generally known as stakeholder theory, which means stakeholder management to try and build a system that is responsive to stakeholder concerns that could be caused by

unprecedented environmental turmoil and change. Values that meet legal requirements, favour for the community and the environment, as well as the bond of the business community to support sustainable development. Stakeholder theory initiated with the assumption that value is explicitly and undeniably a part of business activities (Freeman and McVea., 2001).

Stakeholder theory states the company is not a system that only employs for its own goal, but must also give benefits to all its stakeholders. Stakeholders basically can sway or have the capability to affect the use of economic assets used by the company. Therefore, the power of stakeholders is determined by the size of the power that stakeholders have over these resources (Ghozali and Chairiri, 2007). Stakeholder theory can be misconceived as anti-capitalist, anti-profit, and anti-business efficiency.

Community legitimacy is a strategic factor for the company to expand in the future. This can be worn as a tool to build corporate strategy, especially related to efforts to position oneself in an increasingly advanced society. O'Donovan (2002) argues that organizational legitimacy can be seen as something that society offers to companies and something that companies want or look for from society. Thus legitimacy is a benefit or potential resource for the company to survive.

Legitimacy theory states that the appreciable the likelihood of a bad shift in social insight of how an organization acts, the greater the willingness on the part of the organization to try to manage this shift in social perception. Legitimacy can be obtained if the company's existence does not interfere with or by the values that exist in society and the environment. When there is a shift towards incompatibility, then at that time the company's legitimacy will be threatened, so it can be stated that the company's legitimacy is in the eyes of the company (Deegan, Rankin, and Tobin, 2002). When there is a shift towards incompatibility, then at that time the company's legitimacy will be threatened, so it can be stated that the company's legitimacy in the view of stakeholders is a significant factor to support the company's image and reputation.

3. Case study of ESG Investing: Indonesia

Mentioned in an article in the Western Asset in 2019 from the ESG Framework covering water access and management, food security and management, energy access and management, emissions and environmental policies, etc., in environmental aspects. Meanwhile, in the social aspect, there should be recognition of equity, labor market capacity and structure, control of corruption, income dispersion, etc. In the aspect of governance, it also includes the institution’s framework, economic management, development model, redistribution pressure, centralization, etc.

In an article written by Wongtrakool and Wontae (2019) in Western Asset. They discussed ESG Investing in Indonesia, especially in the sector aspects of the ESG framework with ESG factor assessment key. The tropical season in Indonesia makes the rainy season last for 58% of the year. There will certainly be no drought in Indonesia and the water supply in Indonesia is recorded at 21% in the Asia Pacific region. However, with several problems such as sanitation and pollution problems, the Indonesian government seems eager to improve the sanitation system. Meanwhile, in the food sector, unfortunately, it is still ranked poorly on The Economist's Global Food Security Index, placing 69th out of 113 countries. In the energy sector, Indonesia is quite advanced in spreading energy to rural areas. However, in the field of emissions, Indonesia still has to make improvements.

In the social aspect, it is undeniable that Indonesia's demographics and diversity are in the top four ranks in the world. Unfortunately, there are still problems in the labor market. Despite Indonesia's lack of human resources, labor issues are still a challenge due to the imbalance of job opportunities for women in Indonesia.

In addition, the income gap is also one of the problems in Indonesia. Talking about equity, the biggest problem in Indonesia, corruption, still needs to be handled seriously. In terms of governance in the institutional framework, new policies have been launched. Indonesia is currently easing foreign investment.

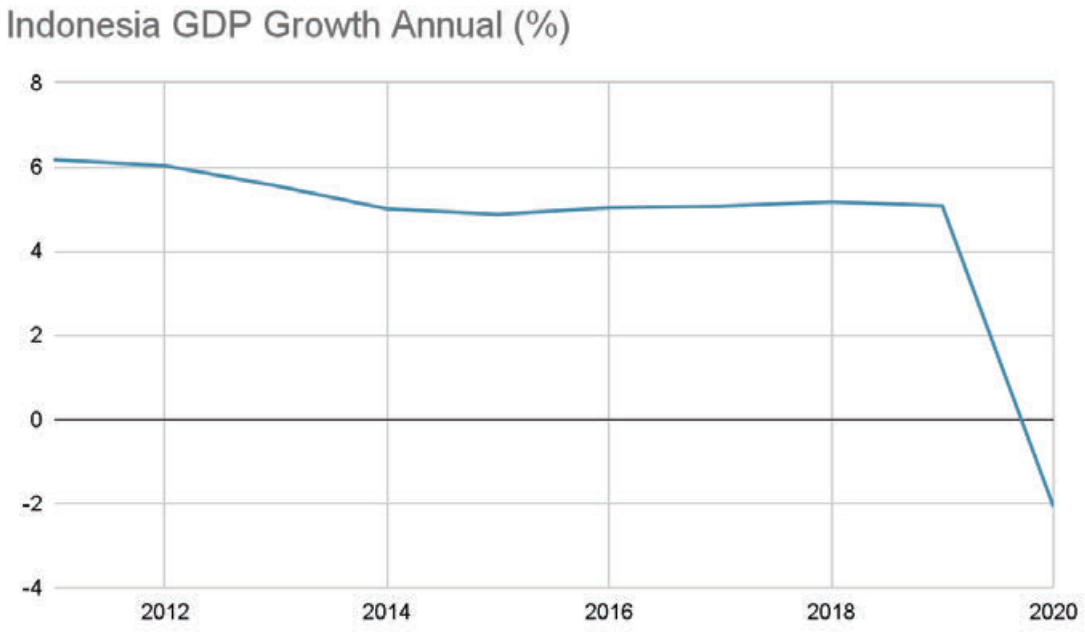

Figure 1 Indonesia GDP Growth Annual (%) 2011-2020, in 2020 GDP declines due to COVID-19

The World Bank recorded Indonesia GDP Growth Annual (%) tend to be stable. This case study has studied Indonesia as an institution itself and how domestic or foreign investors look into the institution itself to decide whether to invest or not. As we can see, Indonesia still needs many improvements and innovation and ESG could be one of the strategies that need to be heavily implemented.

4. Future Prospect

Understanding the characteristics of sustainable development briefly calls for building a society that has a balance between economic, social, and environmental goals.

A strong ESG premise can increase return on investment by granting capital to more promising and more sustainable chances, such as renewable energy or waste reduction. It can also help companies avoid stuck investments that may not pay due to long-term environmental concerns such as a major drop in the use of oil tankers. Continuing to depend on energy-intensive instruments, for example, can cost you money in the future. While the investment needed to renew operations may be large, opting to just wait can be the most expensive option (Velter and Stawinoga, 2016).

From an investor's perspective, two things are considered to be big challenges. First, investors believe that to remain in the short term, companies must focus on maintaining liquidity and protecting the company's financial health. Second, investors want companies to take a through-cycle view and make investments that will help them win in the medium and long term (Farag et al., 2020). That could mean continuing to spend on research and development and or even making selective acquisitions during a downturn.

ESG in its application will have an impact on energy-based industries in the near future. The improvement of ESG practices will require greater global engagement among policymakers, the financial industry, end investors, and other stakeholders who help shape ESG practices (Boffo and Patalano, 2020). While progress has been made to develop ESG practices by some ESG framework contributors and various regulators, it has emphasized the endurance of metric inconsistencies and the lack of comparative risk. More efforts are needed at the global level to ensure that ESG practices develop further in a way that does not cause market dispersion, and support investor confidence and market coherence.

There appear to be several valid reasons why sustainable organizational investments can increase their shareholder value. When the company fulfills its fiduciary responsibilities to its investors; there is a high possibility to work harder and exceed its financial return obligations and include ESG factors (Hassan and Roychowdhury, 2019).

5. Discussion and Conclusion

More in the future, investors will look at how they invested their money. Invest to generate measurable positive social or environmental benefits. Then how should the company's ESG commitment be during the current pandemic? According to a Boston Consulting Group (BCG) publication entitled “ESG Commitments Are Here to Stay” in 2020, many investors give companies the tolerance for delaying or even leaving some sustainability targets unachieved, in order to survive the financial crisis. ESG investment could take a surprising turn for the pandemic. As can be seen in the stock market, ESG-focused mutual funds have outperformed their traditional complement, while seeing much higher net inflows.

Promoting strong corporate governance in protecting the environment and supporting various groups is one of the things that investors want their shares in various parts of the world. Companies should make good portfolios and attract investors' attention.

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Trends and Directions of Agricultural Innovation Development for Thailand: Digital Agribusiness, Agribusiness Service Business and Novel Farming Business

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Abstract

Agriculture is the foundation of Thailand's economy and society. However, the current global disruptive change in technology and innovation has shaken up all Thailand's economic sectors including agriculture. If Thailand cannot determine the directions and policies for developing technology and innovation appropriately, the country may lose its competitiveness. This research aims to analyze trends in innovation development in 3 agribusiness sub-sectors to help formulate policies reasonably and efficiently. The researchers used mixed methodology, which is secondary data collected from documents, research, digital trend analysis, focus grouping with innovative business actors and stakeholders in Thailand, and in-depth interviews with seven foreign participants from 4 countries.

The finding revealed to 3 agro-innovation business groups, namely: 1) The digital agribusiness group consisted of automated agriculture, data, and image analysis by artificial intelligence, blockchain for agriculture, and digitizing aroma and taste. 2) Agribusiness service business consists of an online platform for high-speed delivery of agricultural products and foods, automated food delivery, an online platform for agricultural service on-demand, agricultural chatbot, and niche food and agricultural services. 3) Novel farming business group consists of big plant factory for the economy of scale, closed-type indoor insect farm, urban farming, harvest on demand vegetable, breeding of organisms for a new farming model, and plant factory for high-value herb. The finding also stated several policies to drive these trends. This study will benefit the formulation of policies to promote and develop agricultural innovations in Thailand in the future.

Keywords: *Trends, Future, Digital agribusiness, Agri-service business, Novel farming, Thailand.*

1. Introduction

The agricultural sector is the foundation of Thailand's economy and society. About a third of the country's workforce is in agriculture. However, Thailand's farming efficiency is still lower than many other countries, partly due to a lack of technology and innovation. In recent years, there has been a rapid change in technology and the emergence of numerous innovations that have increased the agricultural production potential of many countries worldwide. In this circumstance, if Thailand cannot correctly determine the direction and policy in technology development and innovation, it may cause the country to lose its competitiveness. Analysis of trends in innovation development in second agricultural innovation business group (set the group by National Innovation Agency of Thailand) which are Digital Agribusiness, Agri-business service, and Novel farm management business model will help to formulate policies related to these three business groups to be reasonable and practical.

2. Objectives

To collect and analyze the overall picture, trends, and ways to upgrade Thailand's agriculture with innovations in digital agribusiness, agribusiness service business, and novel farm management business model

3. Research Methodology

The researchers used mixed methodology, secondary data from documents and research publications were collected. The primary data was done by focus groups with innovative businesspeople and stakeholders in Thailand, and in-depth interviews with seven foreign participants from 4 countries. This study also used data analysis from Google Trends and BuzzSumo to analyze the trends and directions of future agricultural innovation development in Thailand. The researchers analyzed and presented descriptive data.

4. Definition of Terminology

4.1 Digital Agribusiness

The innovation that uses the application and various communication or electronic devices for agricultural information management or the environment control data to lead effective agricultural decision making and planning.

4.2 Agribusiness Service Business

The Agribusiness integrated into the trading of agricultural products by creating a new agricultural business model, such as sharing agricultural machinery and

equipment—providing a new form of service instead of human labor, creating a new online market.

4.3 Novel Farm Management Business

This business model is novel farming systems, indoor farms, aquaculture, insect, & algae production. They use technologies such as produce agricultural products from an extensive indoor crop system, an insect farming business that uses insects as raw material for animal cooking, fertilizer, and human food technology. They provide complete equipment and consultancy for a plant factory system.

5. Findings

5.1 The Trend of Innovation Development in The Digital Agribusiness Sector

5.1.1 Automated Agriculture

The labor shortage in agriculture is a major global trend right now. Previously, agricultural work was done by a combination of human and machine labor. In the future, farming will only use machine labor. This idea was proven possible by the Hands-Free Hectare project in England. In terms of agriculture, the transition to the automatic agriculture era will occur with the production of field crops first because there is a process of care and harvesting that requires little detail. Nevertheless, in the end, the robots will be harvesting crops like strawberries. With animal husbandry, it is also moving towards automation, as is the case with a robot called Vector, made by Lely, that can mix and feed the animals automatically.

5.1.2 Data and Image Analysis by Artificial Intelligence

Globally, agricultural data analysis using artificial intelligence has become mainstream. It can be predicted that the near term (1-5 years) trend that will come next in the innovation of the digital agribusiness group is to focus on developing digital photo data analysis systems by machine learning, to advise the farmers themselves and direct the machines to automate certain activities, such as harvesting produce. Pesticide spraying and ultimately, digital photo analysis technology in agriculture will become critical foundations for the upcoming trend of automated agriculture in the long term (10-20 years).

5.1.3 Blockchain for Agriculture

Blockchain will become the new standard of agricultural products both nationally and internationally. As with Walmart, the U.S. retail giant, which plans to begin requiring supermarket vegetable deliverers to record data in IBM's Food. Trust systems may not be

limited to using blockchain for agricultural data collection or food source information only but may also include plant genetic information, which will be a reference to verify the ownership of a species. Blockchains have an intelligent contract system that allows everyone on the network to agree. This system works as an automated organization without intermediaries. Therefore, using blockchain can reduce transaction costs. Blockchain cannot solve every problem in the food supply chain. However, blockchain has three main advantages that make it ideal for agricultural data collection. First, data already saved on the blockchain cannot be deleted or modified. Second, the data recorded on the blockchain must also be timestamped and cannot be changed. Third, it is possible to retrieve information on the origin of the food immediately because all the information is distributed to all network members. Traditional traceability systems can take weeks to get all the information, as the stakeholders keep only some of the data.

5.1.4 Digitizing Smell and Taste

A long-standing problem in the food and agriculture industry is controlling the quality, aroma, and taste of products. These touches are not standardized as none can effectively capture flavor and aroma information. Start-up companies like Aromyx have developed technology to address this problem by creating tiny chips with olfactory receptors that mimic the human nose and tongue. The chip can receive odor and flavor information of the sample; after the chip is inserted into the reader, data will be uploaded to the cloud. The data is then analyzed for comparison with a database whereby customers can compare and analyze the aroma and taste with precision. It can also analyze food contamination and spoilage. This technology has gained much attention, as evidenced by receiving the business idea winner at the 2019 World Agri-Tech Innovation Summit (March 17-18, 2019) in the United States.

5.2 Agribusiness Service Business

5.2.1 Online Platform for High-Speed Delivery of Agricultural Products and Foods

The trend of online shopping continues to expand. The Electronic Transactions Development Agency report that the value of electronic transactions in Thailand is growing at approximately 8.76% per year, reaching 2.8 trillion baht in 2017. Food and agricultural products were sold at 220,978. Million baht is the second highest of all goods and services (DOE, 2018). Therefore, the online food shopping market in Thailand is likely to be still able to grow a lot and should be in line with the growing trend of online shopping. Creating an online platform for selling and delivering food should be mainstream in the next 1-5 years. The speed of delivery will be a critical factor in determining the success of any agricultural and food delivery company. Consumers who use food and goods delivery services are more

likely to be accustomed to convenience (and increasingly demand faster delivery times (Angus and Westbrook, 2019).

5.2.2 Automated Food Delivery

The labor shortage in the service sector will be a key factor driving the development of automated food transport systems. As with Kiwibot, a near-field automated food delivery service that has been in operation in Berkeley for two years. Despite experiencing some obstacles, Kiwibot has continued to improve. People seem to have accepted this little four-wheeled robot as if it were a part of the community. This can be seen from the destruction of one of the robots last year. The University of California, Berkeley, has even issued an official mourning announcement for the striped robot. Amazon is also working on an autonomous delivery system that includes both 6-wheeled robots and drones. In the case of 6-wheeled autonomous delivery robots, testing began in 2019. Moreover, at the World Agri-Tech Innovation Summit (March 17-18, 2019), panelist Jeff Housenbold from the Softbank Vision Fund discussed the potential for autonomous food transport (ACF) to make a turn in the agricultural sector.

5.2.3 Online Platform for Agricultural Service on Demand

There are many on-demand service platforms via smartphones in Thailand. The highlight is Line Man, which offers both food purchase, delivery services, send documents and parcels. The details of the service are very flexible and allow customers to save time in various transactions. In the agricultural sector, there is no such service platform in Thailand. Predictably, there will be some interest in creating a platform that allows those who want to use the service to meet with service providers. If farmers have access to services such as tractor tilling, drone spraying, and harvesting by machines easily by using a smartphone, it will benefit quite a bit. It will allow free competition in agricultural services and allow farmers to receive services quickly without losing the opportunity to sell their produce at high prices. A prominent example is the sugar cane industry. Sugarcane farmers usually have a few months to deliver the sugarcane crops to the mills. If the harvesting machine operator does not have an empty queue, farmers may also lose the opportunity to sell their produce. If a platform allows farmers to discover who is available quickly, this will reduce the risk.

5.2.4 Agricultural Chatbot

Customer service is a labor-intensive task to discuss and solve problems. Provide information and impress customers but the trend of modern people interested in this work is less and less. In Thailand, Siam Commercial Bank and Bank of Ayudhya have used chatbots for customer service. Agribusiness is also involved in customer service work. Some overseas

companies have begun to develop chatbots. For example, U.S. company WeGrow developed a chatbot application to advise on growing cannabis at home. Equipment purchases various cultivation techniques, Including helping to solve problems during cannabis cultivation. The operating system of the application looks like a conversation with a personal assistant. The system is collecting learning conversations in the form of artificial intelligence will enhance services in the agricultural sector (Raguse, 2017).

5.2.5 Niche Food and Agricultural Service

The changing needs of consumers resulting in news consumption patterns; hence, some start-ups are born to serve the needs of consumers. For example, Le Cupboard in San Francisco, which sells 100% plant-based food, is aimed at vegans. It offers both restaurant and food dispenser formats and the All-plants website, which offers vegan food sales and delivery. In Thailand, niche food services have also begun, such as Veget Deli, which delivers organic vegetables directly to consumers to meet the demand for organic food, and Veganerie, a vegan restaurant in Bangkok. However, the variety and number of companies serving niche food are not as much as in foreign countries. Therefore, it is a market that can still expand considerably. This new consumption pattern has also resulted in a change in farming patterns. Specialized agricultural service companies, therefore, have more business opportunities**.**

5.3 Novel Farm Management

5.3.1 Big Plant Factory for Economy of Scale

Economies of scale will become the heart of the plant factory business, which has a high cost. Therefore, the new start-up companies will mainly focus on developing farms of about 5,000 square meters or more. The contributing factor is the reduced cost of structure and system operating costs since LED lamp technology is becoming more and more efficient while keeping the cost of the lamp itself. Accumulating knowledge from research and lessons learned from failed crop plant start-ups will play a key role in driving the trend for large-scale plants in Thailand.

5.3.2 Closed-Type Indoor Insect Farm

Consumer acceptance of insect-derived food is increasing. The European and Canadian governments have authorized the use of insect-based food for aquaculture. In Thailand, although there are many insect farms, most are community enterprises without strict environmental controls. Therefore, they must bear the risk of climate variations that may hurt the quantity and quality of insects. As the insect industry is highly valued, it is possible to apply closed indoor farm technology to control environments to achieve stable and

standardized production quality to produce pesticides in the future. Export Entrepreneurs who run insect farms agree with this idea.

5.3.3 Urban Farming

Urban farms occur in major cities around the world, such as in Tokyo. Japan The Tokyo Metro, which operates and operates the Tokyo Metro, initiated vegetables in plants in the subway area. This case's essential advantage is that it is part of the transport system that facilitates the transport of produce to different points within the city. This is a key advantage of urban farming, which reduces pollution. This is due to transporting produce and is likely to be of particular interest in Thailand, which recently faced significant air pollution in early 2019. Some companies in Thailand have designed equipment and furniture that allow urban people to grow plants in their homes or offices. Urban farming does not always have to be done in a closed system. Many examples exist in large cities where open spaces are not utilized, such as rooftops or unused parking lots. It's used to grow vegetables or make flower gardens as a source of oxygen and promote interaction between people for the community.

5.3.4 Harvest on Demand Vegetables

Consuming fresh produce is one of the top desires of most consumers, same as delivering live, rooted vegetables to consumers. Therefore, it is an opportunity for consumers to cut vegetables and eat by themselves when they want. However, the idea needs to be tested more extensively due to transport restrictions and the consumers' convenience of storing live plants. An example of a business that uses this concept is Farmers Cut from Germany.

5.3.5 Breeding of Organisms for New Farming Model

Over time, the crops for traditional farming have been improved to achieve high yields. Disease and insect resistance and providing products with desirable characteristics for consumers under natural environments but the new farm environment differs from traditional farming. Therefore, it is highly likely that species developed for traditional farming systems will exhibit different characteristics and yields in the new farming system. Breeding organisms for farming in indoor or vertical farming systems makes perfect sense. Plant varieties grown in a manufacturing plant may face limitations such as light quantity, height, and some disease outbreaks are more prone to planting under natural conditions. Some companies have initiated cultivar selection and breeding of plants for planting in plant production systems**.**

5.3.6 Plant Factory for High-Value Herb

The interest in plant technology in Thailand has become more and more pronounced

over the past two years. In other countries, plant systems have been used to produce essential medicinal substances in many cases, such as vindoline and catharanthine from watercress (Catharanthus roseus), a precursor to the synthesis of high-value cancer drugs. Research has shown that growing watercress under a plant by providing red light at appropriate intensity can stimulate the production of these compounds (Fukuyama et al., 2015). Once again, some environmental modifications in a plant system can stimulate the production of high-value plant essences, which is an example of the advantages of plant-plant systems compared to traditional crop production.

6. Policy Suggestions

6.1 Digital Agriculture Group

For policies to support digital agriculture groups should be 1) the development of the national agricultural data center; 2) to increase incentives for companies, investors, and potential experts; and 3) the creation of a machine learning platform and curriculum such as Blockchain Development.

6.2 Agribusiness Service Business Group

For the policy to support the agribusiness service business group; 1) establishing rules and regulations to facilitate online platform business; 2) opening the space to experiment with new digital platforms that may not be legally supported; 3) building a network, and 4) reducing the influence of local traditional agricultural service providers.

6.3 Policy for the Development of a Novel Farm Management Business Group

For the policy to develop a new farm management business group; 1) promoting cooperation with specialized start-up companies and building model factories for education; 2) establishing the Plant Factory Association and the Insect Farmers Association of Thailand; 3) promote urban farming for communities, and 4) funding for bio-breeding projects for new farming practices.

7. Conclusion

To collect and analyze the overview, trends, and ways to upgrade Thailand's agriculture with innovations in the agricultural innovation business group 2 were identified. These are as follows:

- Digital Agribusiness consists of automated agriculture, data, and image analysis by artificial intelligence, blockchain for agriculture, and digitizing aroma and taste.
- Agribusiness service business group consists of an online platform for high-speed

delivery of agricultural products and foods, automated food delivery, an online platform for agricultural service on-demand, agricultural chatbot, and niche food and agricultural services

- Novel farm management business group consists of big plant factory for the economy of scale, closed-type indoor insect farm, urban farming, harvest on demand vegetable, breeding of organisms for a new farming model, plant factory for high-value herb.

This study will benefit public or private organizations in formulating policies to promote and develop agricultural innovations in the future.

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Differential Grape Harvesting: Two Case Studies to Produce Red Wines with Enhanced Rotundone Concentration

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Abstract

Rotundone is the main compound responsible for peppery aroma in red wines. A large spatial variability in concentration of this compound has been reported within the same field, associated with variation in vine water status and berry temperature during ripening. This opens opportunities to manipulate rotundone concentration in wines through differential harvesting. In order to determine practical ways to map rotundone concentration, studies based on stratified sampling were conducted in the South West of France. On a Duras vineyard, variability in vine architecture was assessed through measurements of trunk circumference (TC), a proxy for water and nitrogen constraint experienced by the vine since its plantation. On the basis of the three classes of TC obtained, smart points (SP) were positioned and independently monitored for quantitative and qualitative production parameters. Despite very low variability between SP for most of the measured variables, rotundone concentration was 50% higher in the wines from the high TC area. The same methodology was used on a Syrah vineyard and did not lead to the same results. No differences in vine water status was observed between the SP which indicates that temperature is likely to be the key factor affecting rotundone at an intra-block scale. The following season, loggers were positioned to monitor bunch air temperature within the same vineyard. At each logger, a sampling area was delimited to collect data on topography, soil stoniness, vine behavior and fruit characteristics. Rotundone was best correlated with the Cool Night Index (CNI) and the percentage of stoniness. Depending on the site, results from our studies highlighted that either these two latter parameters or TC can be used to approach rotundone spatial distribution.

Keywords: *wine, rotundone, peppery aroma, intra-block variability, differential harvesting*

1. Introduction

Rotundone is the main compound responsible for peppery aroma in red wines (Wood et al., 2008). Since its discovery in an Australian Shiraz wine, it has been found in high concentrations in wines made from various cultivars such as Duras, Gamay, Grüner Veltliner, Noiret, Schiopettino or Vespolina (Geffroy, Kleiber, & Jacques, 2020). It has been shown that rotundone distribution within the same vineyard block was spatially organized and that structural patterns were stable from one year to the next (Bramley, Siebert, Herderich, & Krstic, 2017). The observed variations can be related either to bunch zone air temperature (Zhang et al., 2015) or to vine water uptake (Geffroy et al., 2014) as observed in Australia or in the southwest of France, respectively. In this latter wine region, good correlations (R^2= 0.76 in 2011 and R^2= 0.74 in 2012) between rotundone and $\delta^{13}C$, a proxy for water constraint experienced by the vine plant over the maturation period, were found within the same vineyard (Geffroy et al., 2014). More generally, These findings make it possible to organize differential harvesting, with the aim of producing wines with distinct levels of rotundone concentration from the same vineyard block. This article provides two case studies to indirectly get access to rotundone spatial distribution.

2. Case Study Number 1 : Vine Water Uptake Is Driving Rotundone Spatial Variability

2.1 Material and Methods

2.1.1 Experimental vineyard, climatic background and sampling optimization protocol

The experiment was carried out in 2014 on a 0.41 ha Guyot trained Duras vineyard from the southwest of France planted in 1999 with 2.20 m × 1 m vine spacing. The plot was selected because a large spatial variability of rotundone concentration related to differences in vine water uptake had been reported in a previous study (Geffroy et al., 2014). It is located in an area under oceanic climatic influence with normal annual rainfall and mean air temperature over the 1981-2010 period of 638 mm and 12.9°C, respectively. An approach based on stratified sampling which can be summarized here briefly was used. Variability in vine architecture was first assessed during winter dormancy through measurements of mean trunk circumference (TC). Twenty-five plots made of four consecutive vines in a row were selected and TC was monitored at each plot at three different heights. According to Tisseyre, Ojeda, Carrillo, Deis, & Heywang, (2005), this integrative variable reflects, among other factors, vine response to water and mineral deficits since plantation and thus can be used to determine areas of high water deficit when monitored along with other variables to assess vine nutrition. Data collected were normalized and spatialized through the kriging method (Figure 1A). On

the basis of the three classes of TC obtained, six smart points were positioned with A and B corresponding to high, C and D to average and E and F to low TC classes. Each smart point consists of 50 vines selected over five different rows and the six smart points represent 17.5% of the whole block area.

2.1.2 Vegetative growth, mineral uptake and water deficit

Phenology was monitored and several indicators were used in order to independently reflect the vegetative growth and expression of the vine for each of the six SP. Shoot elongation, an early indicator of water deficit was monitored weekly on three smart points (A, D and F) between 100 and 500 growing degree days (GDD) on trellised shoots (4 shoots per vine and 4 consecutive vines per smart point). Remotely sensed imagery (airborne multispectral video imagery with a ground resolution of 50 cm) of the plot was obtained at veraison, on August 4th. Number of shoots and pruning wood weights were measured in January 2015 on the whole plot through Physiocap®, a new system to measure the number and the diameter of vine shoots. On each smart point, pruning wood mass (kg/vine) was also measured individually for 30 out of 50 vines. The uptake of mineral elements was accessed through petiole analyses (major and trace minerals) on an average sample of 50 basal leaves (1 per vine) at six key time points between flower cluster with floret separation and harvest, on three smart points (A, D and F). On each smart point, nitrogen status was also characterized on 50 leaves (1 leaf per vine) through measurements of Dualex® (Force A, Orsay, France), a fluorescence based sensor which allows the calculation of a chlorophyll flavonols ratio named NBI® (Nitrogen Balance Index). For each smart point, stem water potentials (Ψstem) were measured from 10 of the 50 vines at 4 time points (closing of the bunch, mid-veraison and harvest).

2.1.3 Fruit composition and rotundone

For each smart point, six grape samples were collected between 10 days before mid-veraison and harvest. Each sample consisted of 200 berries from both sides of the row and several parts of the cluster. After weighting, crushing and centrifugation, potential alcohol, titratable acidity, pH, malic acid, yeast assimilable nitrogen (YAN) and polyphenolic compounds (harvest sample only) were measured. For each smart point, 600 berry samples were also collected at harvest for indirect determination on rotundone in wines prepared by microvinification techniques (1-L Erlenmeyer) according to the protocol described by (Geffroy et al., 2014). For each smart point, the 50 sample vines were harvested and yields at harvest (kg/vine) were monitored individually. Statistical analysis Statistical analyses were conducted with Xlstat software (Addinsoft, Paris, France). Analytical data with replicated

measurements (stem water potentials, NBI, yields at harvest and pruning wood weights) were subjected to an ANOVA treatment. Fisher's least significant difference test was used as a post-hoc comparison of means at $P < 0.05$. Principal component analysis (PCA) was employed using means for each of the smart point for most of indicators followed, with rotundone as an additional variable.

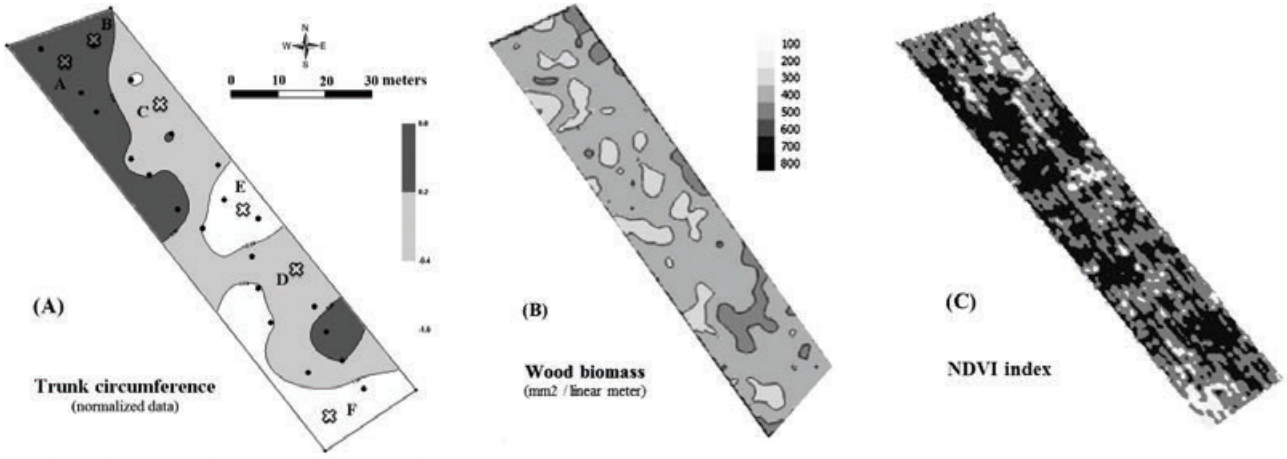

Figure 1 Variation in (A) trunk circumference, (B) pruning wood biomass, and (C) NDVI index in a 0.41 ha Duras vineyard in the South West of France.

2.2 Results and discussion

2.2.1 Agronomical behavior of the smart points

No differences in bud break date nor in other phenological stages were observed between the smart points. From 350 GDD which corresponds to 5 days before berry set, shoot elongation started to slow down on smart point F (results not shown). This deceleration could be linked rather to an early water deficit than to a nitrogen deficiency (Table I) as higher NBI values were recorded on lower TC smart points (E and F). Both indicators i.e. petiole analysis (results not shown) by reference method and NBI showed lower nitrogen content in the high TC smart point at berry set which suggests a dilution of this element. While Physiocap® measurements showed a relative good homogeneity of the plot for pruning wood biomass (Figure 1B), manual weighing tends to strengthen this hypothesis (Table I) as higher average values - non-significant statistically - were recorded on smart points A and B. As the vineyard block was characterized by a significant rate of missing plants (15%) with high mortality due to trunk diseases, Physiocap® measurements which occur at a frequency of 1 Hz, may have been biased toward the detection of spatial variation reflecting areas with more missing plants than biomass differences between healthy vines. The month preceding veraison and far

beyond until the end of August, frequent rain events contributed to the development of the inter-row grass cover crop. Despite potential signal perturbation due to the presence of this green cover at veraison and the high percentage of missing plants, NDVI spatial pattern (Figure 1C) tends to visually overlaying the TC map. At closing of the bunch and veraison, probably because of the heavy rains, Dualex® measurements were perturbed. Due to bad weather conditions, measurement of stem water potential at veraison was delayed of 25 days and at harvest, leaves were in a bad condition to perform the measurement. Stem water potential especially at closing of the bunch, allows a perfect discrimination of the smart point according to the classes of TC defined. This observation corroborates previous research works (Tisseyre et al., 2005). According to the threshold defined by van Leeuwen et al. (2009) water deficit experienced by the vine on the plot was null to weak. Surprisingly at harvest and possibly earlier in the season, nitrogen status from the average TC class as reflected by the NBI values in leaves and YAN in grapes presented higher nitrogen levels which may be the combined effect of a better assimilation in comparison with the low TC smart points in relation with water deficit, and of a lesser dilution in comparison with the high TC smart points. In terms of sugar accumulation over the maturation period (results not shown) and polyphenolic concentrations in grapes at harvest (Table 1), little differences were noticed between the smart points.

Table 1 Differences between the smart points for several parameters followed over the vine growing season and winter dormancy. [a]Pruning wood weights. [b]Flower cluster with floret separation.

Parameter	**Phenological stage**	***P*-values**	**Smart point**					
			A	**B**	**C**	**D**	**E**	**F**
Nitrogen status (NBI)	FCFS[a]	0.008	4.40 b	-	-	4.97 a	-	4.72 a
	Berry set	< 0.0001	4.63 d	4.99 cd	5.24 bc	5.33 abc	5.68 a	5.43 ab
	Berry set + 10 days	0.005	4.88 b	4.87 b	5.11 ab	5.44 a	5.50 a	5.44 a
	Closing of the bunch	0.128	5.20 a	5.12 a	5.67 a	5.28 a	5.19 a	5.15 a
	Veraison	0.068	5.12 a	5.11 a	5.63 a	5.49 a	5.39 a	5.63 a
	Harvest	< 0.001	5.71 c	5.86 c	6.64 a	5.51 ab	5.36 ab	6.10 bc
Ψstem (Mpa)	Closing of the bunch	< 0.0001	-0.43 a	-0.42 a	-0.61 b	-0.57 b	-0.63 b	-0.66 b
	Veraison + 25 days	< 0.0001	-0.43 a	-0.39 a	-0.55 b	-0.58 bc	-0.64 bc	-0.67 c
	Harvest	< 0,0001	-0,56 a	-0,54 a	-0,91 c	-0,72 b	-0,82 bc	-1,07 d
Yields (kg / vine)	Harvest	0.194	2.81 a	2.91 a	3.48 a	2.87 a	3.03 a	2.61 a
YAN (mg/L)	Harvest	-	103	89	133	135	114	119
Anthocyanins (mg/L)	Harvest	-	1036	1091	1077	1077	962	1092
TPI	Harvest	-	94	97	92	92	86	97
PWW[b](kg/vine)	Winter dormancy	0.158	0.371 a	0.400 a	0.337 a	0.336 a	0.315 a	0.318 a
Rotundone in wine (ng/L)	Harvest	-	86	103	50	71	75	47

The slight decrease observed on the last sample may reflect more a measurement artefact than a real loss in sugar by respiration. Differences between the smart points were very weak which is consistent with the hypothesis that low water deficit leads to low spatial contrast within the smart points (Taylor, Acevedo-Opazo, Ojeda, & Tisseyre, 2010). Indicators used in routine and well known by winegrowers such as yields at harvest, fruit quality, mineral uptake through petiole analysis, pruning wood weights were not enough powerful to discriminate the smart points from an agronomical point of view while much better results were obtained with trunk circumference, stem water potentials, NBI.

2.2.2 Discussion about the average TC class and rotundone concentration in wine

It is always difficult to position an average class and to relate it either to a lower or to a higher group. This is not an unimportant matter as the average TC area of the studied plot represents almost half of the whole surface (Figure 1A). The wide range of indicators followed during our study and their analysis through a PCA treatment (Figure 2) should allow us to discuss it. It appears that smart points C and D have more similarities with smart points E and F and should be merged with the low TC class when considering selective harvest. This is consistent with the rotundone concentration, with average values of 94.5, 60.5 and 61 ng/L found in wines from the high, average and low TC area respectively. The PCA plots show that rotundone is correlated with variables related directly or indirectly to water deficit such as Ψ stem, weight of 200 berries and malic acid level, which is consistent with Geffroy et al. (2014).

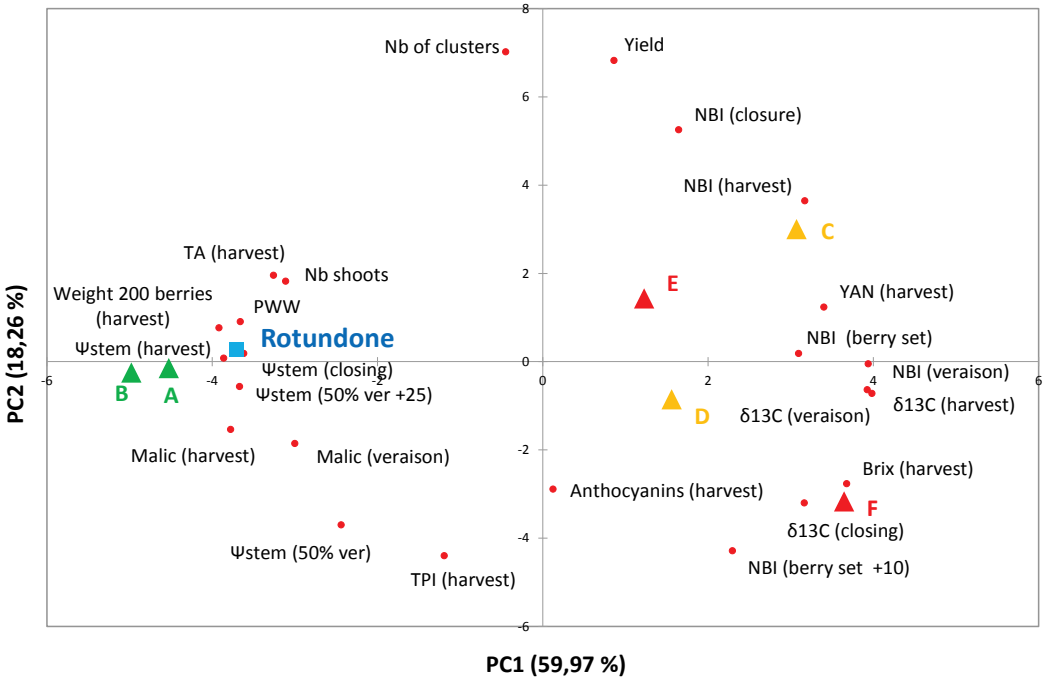

Figure 2 Principal component analysis (PCA) of data collected on the 6 smart points on the experimental Duras block in 2014

3. Case Study Number 2 : Temperature Is Driving Rotundone Spatial Variability

3.1 Material and Methods

In 2015, the same methodology was applied on a neighboring 0.51 ha Guyot trained Syrah vineyard from the South West of France and did not lead to the same findings (results not shown). No differences in vine water status was observed between the SP which indicates that TC variability may be the consequence of distinct nitrogen status and that temperature is likely to be the key factor affecting rotundone at an intra-block scale. The following season in 2016, EBI-20 T1 loggers (Xylem Analytics, Ingolstadt, Germany) displayed in solar radiation shields were positioned at 19 points in the vineyard to monitor air temperature within the bunch zone every ten minutes for 50 days, between mid-veraison and harvest. Temperature data ware used to calculate Huglin index over the period of 1 April to 30 September, the cool night index, the mean air temperature, the maximal air temperature, and the thermal amplitude indices over the veraison-harvest period. Dh25, Dh30 and Dh35, the percentage respectively of degree hours above 25°C, 30°C and 35°C, some variables that are known to impact grape secondary metabolites and rotundone (Zhang et al., 2015) were also determined. At each logger, a sampling area of 21.5 m^2 was delimited to collect additional data. Elevation, slope (%) were obtained through the RGE ALTI model from the French IGN and the stoniness percentage was visually assessed. Data on vine behavior, fruit characteristics at harvest and rotundone were determined using the same methodologies as those described in paragraph 2.1. Data were spatialized using GIS tools and the whole data set was treated through principal component analysis (PCA).

3.2 Results

3.2.1 Variation in temperature spatial patterns

Average temperature varied across points from 20.93°C to 21.62°C. The amplitude of variation was greater for cool night index and maximum air temperature which fluctuated from 12.49°C to 13.92°C and from 30.36°C to 33.28°C respectively. A relative stability in temperature spatial patterns was observed on the block between August 10 and September 29 (results not shown). This indicates that the change in azimuth angle over the 50 days of measurement had a minor impact on the distribution of bunch zone temperature. Surprisingly, the warmest area in the morning located in the center of the block, turned out to be the coolest part of the block during the afternoon and the night. Soil stoniness did not allow to discriminate these two points which were characterized by some of the greatest leaf area and slope.

3.2.2 *Factors driving temperature*

As it can be noticed on the PCA plot (Figure 3), maximal air temperature was best explained by stem water potentials. Leaf temperature is known to increase with the increase in water stress (Jackson, Idso, Reginato, & Pinter, 1981) and we can assume that canopy temperature impacted bunch temperature during the warmest hours of the day. Cool night index was correlated to the distance to the southern end of the vineyard whose surface contained a larger quantity of white stones that might have kept the warmth and released it during the night. No clear relationship could be established between mean temperature and other variables.

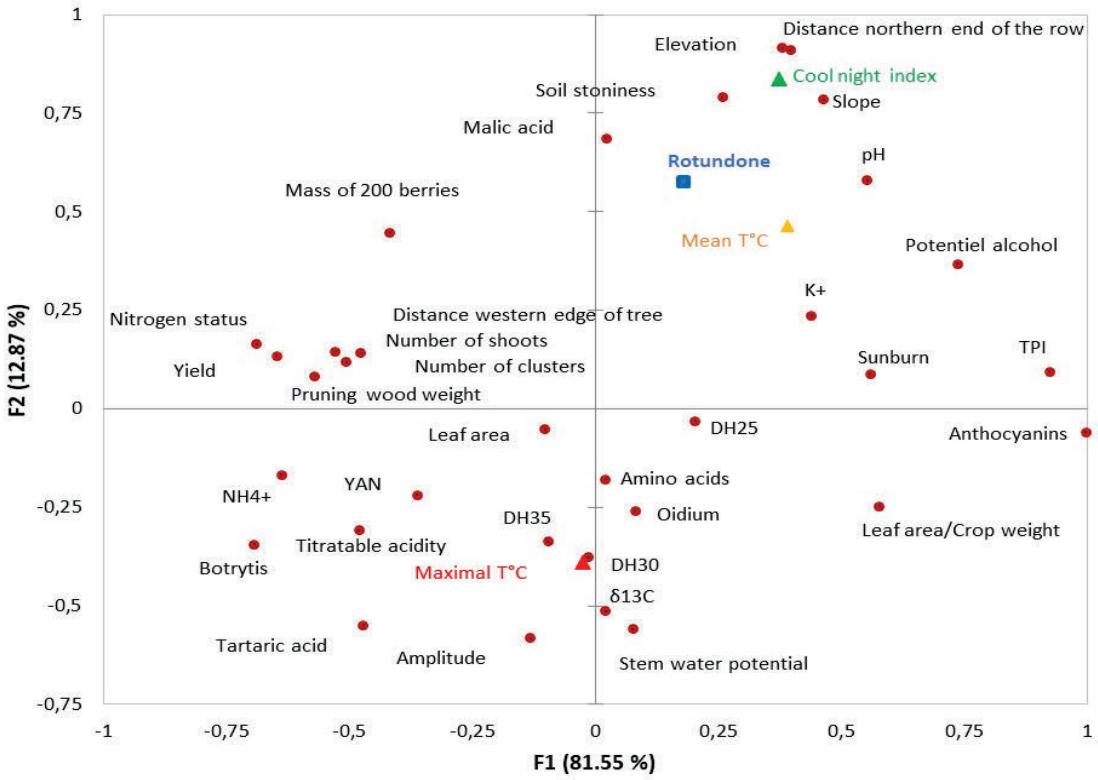

Figure 3 Loadings for a principal component analysis (PCA) performed on the data collected on the experimental Syrah block in 2016

3.2.3 *Impact of temperature on secondary metabolites and rotundone*

The level of water deficit reflected by $\delta^{13}C$ was rather homogenous on the plot (Figure 4) which is consistent with the results obtained during the previous season. Beside water constraint, grape secondary metabolites are also impacted by temperature. Indeed, Dh25 spatial pattern tends to visually overlay the anthocyanins map (Figure 4) which is consistent with previous research showing an increase in anthocyanins levels with an increase in temperature (Mori, Goto-Yamamoto, Kitayama, & Hashizume, 2007). Temperature

exceeding 25°C are known to negatively affect the rotundone concentration (Zhang et al., 2015) and unexpectedly no relationship could be established between Dh25 and rotundone. The best correlation was found between the pepper aroma and the cool night index. The southern part of the plot that gave the wines with the highest rotundone concentrations contained the greatest amount of white stones at the surface of the soil. We can assume that these stones accumulated heat during the day and released it during the night which contributed to increase the cool night index. It can also be hypothesis that radiations reflected by these stones may have contributed to stimulate rotundone production in this part of the vineyard as it was recently proposed (Geffroy, Kleiber, & Jacques, 2020).

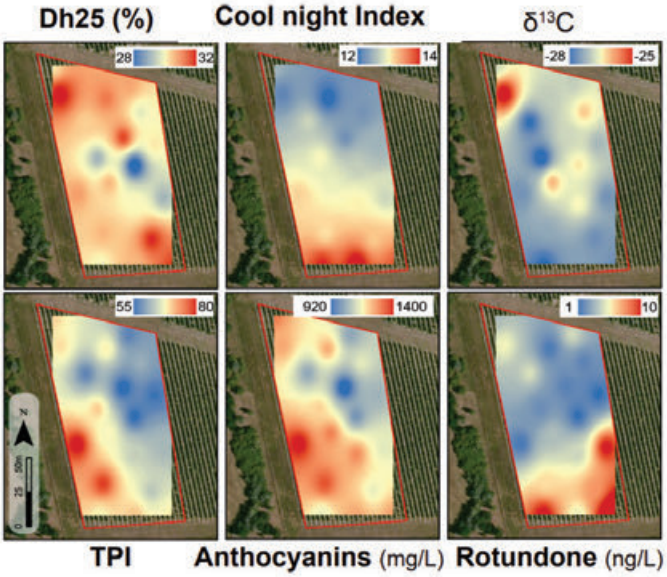

Figure 4 Variation in Dh25, cool night index, $\delta^{13}C$, Total Phenolic index (TPI), anthocyanins and rotundone within the Syrah experimental plot in 2016.

4. Conclusion

The present work enabled to set up a methodology for assessing rotundone spatial distribution. When vine water uptake is driving rotundone spatial variability, TC can be used to map rotundone. Indeed, rotundone was on average more than 50% higher in the wines from the high TC area. This indicator related to plant architecture is particularly cost effective as the time to perform the 25 measurements on the 0.41 ha experimental plot did not exceed one hour. When temperature is driving rotundone spatial variability, the mapping of rotundone is more challenging as it requires the use of temperature loggers. In our case, the best correlation was found between the pepper aroma and the cool night index which could be the consequence of the greatest amount of white stones at the surface of the soil. The radiations reflected by the stones may have contributed to stimulate rotundone biosynthesis as it was recently proposed (Geffroy, Kleiber, & Jacques, 2020).

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Marketing Strategies to Succeed in the Liquor Industry: The Case of Matsu Kaoliang

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Abstract

Matsu Islands are an archipelago that is historically and culturally rich. One of the greatest riches of these islands is the Matsu Kaoliang produced by the local Matsu liquor factory. This distillery produces a high-quality product thanks to the water quality and the particularity of the liquor's production process. For many years, the Matsu Kaoliang has enjoyed popularity in Taiwan and Mainland China. However, changing consumer's preferences have caused a decline in demand and now force the factory to find new markets for its products. The difficulty resides in appealing to consumers who may not know anything about kaoliang or do not show interest to it. Designing an effective marketing strategy that lays on understanding of the market, innovation and smart advertising constitutes the way forward for Matsu Kaoliang.

1. Introduction

On 7 November 2015, an historical meeting occurred in Singapore between former Taiwan's president Ma Ying-jeou and Mainland China's Xi Jinping. Leaders of these two countries never met since the Chinese Civil War. On this occasion, rice wine from Matsu islands was served at the table. This was symbolic because these islands played a critical role in the Chinese Civil War.

The islands are a short distance away from mainland China. The archipelago of Matsu obtained its name from the goddess Mazu, the deity of seafarers, which is celebrated magnificently in mainland China and Taiwan. As a human, goddess Mazu was called Lin Moniang. According to the legend, when she was 16, Moniang saved one or some members of her family during a typhoon. Since 2009, there is a giant statue of Mazu in Matsu Village on Menqian Mountain, and it is the tallest statue of the goddess in the world.

Matsu is a marvelous location for fishing, making this sector a pillar of its economy. Different kinds of seafood are available during each season. However, in recent years, the fish population has been decreasing and the sector is affected by overfishing by mainland China boats. Along with the fishing sector, the winemaking industry of Matsu Distillery is the most prominent. Matsu is well-known for its appreciated local wine, including Matsu Aged Liquor and Tong Yung X'Old Kao Liang Liquor. Tourism has become a highly important asset for the economy. Birdwatching, wine tasting, the military history and religious celebrations for the goddess Mazu attract many tourists. In the farming sector, the most important production are rice, sugar cane, tea plant, and orange. Lastly, retail businesses and the service industry contribute to support the economy. They mostly serve the soldiers stationed in the area since many of the islands are not permanently inhabited. Matsu Island is known for its red yeast cuisine, pickled vegetables, pastries and seafood products.

2. Matsu Liquor Factory

Matsu liquor factory is tremendously notorious for its flavorful wines. Matsu liquor factory was built in 1956 to provide a taste of home, a delectable wine to the residents of Matsu, especially the Taiwanese soldiers stationed on the islands. The factory currently has two strong manufacturing bases that are located precisely on two islands, Nangan and Dongyin. Both of the manufacturing factories are heavily supported by the government and produce unique quality of wine. The liquors constitute the main source of income for the island. The factory has been growing in popularity and is currently looking to expand to the foreign markets.

Nangan factory was originally named "Chung Hsin factory". This factory produces only three type of wines, which are yeast Sorghum, Shaoxing and medicinal. The winemakers follow their unique and best recipe to produce high quality wines. On Nangan island, there is the "88

tunnel", which is considered an excellent spot for storing the wine. The "88 tunnel" is not only known for its capacity to provide an incredible taste and fragrance to the wine but also for its use in the early years as a defensive military fortification to protect the territory from pirates' attacks. This military facility has been a great use in the wine production process.

Dongyin factory was known as Chung-hsin liquor factory, Thungyin Branch" and established during wintertime. It is especially famous for Dongyong old sorghum wine, which is naturally prepared and fermented through traditional methods. In Dongyin, the winemakers use the mountain spring water that is distilled through Zeolites to make the wine, while taking into account the right temperature, humidity, and bacteria. The factory's experienced winemakers are the ones who decide the time needed in order to brew the old sorghum wine. This wine has a precious value for the Matsu's residents and they love it for its unique taste. Dongyin was used to produce medicinal wine that was said to be effective in curing rheumatic diseases but ceased their mass production in recent years.

3. Wine Production Process

The process of making this wine has not changed at all since the beginning because the workers have passed down their unique traditional techniques to ensure the products' quality. In the sorghum wine production process, a particular step heavily influences the overall quality of the finished product: the mixture has to be stirred very evenly so that each batch can ferment properly. The fermentation process takes at least two weeks after which the distillers decide exactly when to start the distillation process.

The distillers use part of the island military fortification (88 tunnel), a crucial step that gives Matsu Kaoliang its unique taste. This tunnel was turned into an ideal space for each liquor. The temperature in the tunnel and the humidity remain constant all year around, between 15 and 20 degrees Celsius, which makes it very well suited for storing liquors. After 3 to 5 years, the liquors turn out delicious and pleasant with its original fragrance. The clear sweet mineral water, dripping off the granite walls of the tunnel is another factor that contributes to the Matsu liquor's unique taste.

The sorghum liquor factory has gained recognition at several international spirits competitions in recent years. The liquor is put under the alcohol cellar for over 15 years allowing the wine to reach a smooth and mellow texture. In May 2008, the liquor was assigned at the state banquet, where president Ma Yingjiu and the Vice-President were greatly enjoying the rich liquor with full, pleasant flavors. Since then, Matsu's liquor reputation started to sweep out over the entire Asian continent and its popularity is just keeping on increasing, after the mass broadcasting by the local media (*MATSU LIQUOR FACTORY CO, LTD. N. D).* Therefore, Matsu liquor factory became more profitable and now the county aims to make it

available in the foreign market. Matsu is actually making unlimited progressive steps towards endless success for the liquor company.

4. Business Model

4.1 Key Partnerships

The Liencheng government owns Matsu Liquor Factory, although it is run as a private company. The government works hard to promote Matsu liquor in Taiwan and China.

4.2 Key Activities

The Matsu Kaoliang Factory focuses on producing sorghum wine, medical rice wine and some red yeast derived products. They sell their products in stores around Taiwan and mainland China.

4.3 Key Resources

The factory's operations are semi-automated as a way to preserve taste by following the old masters' methods. Human resource is, thus, essential. The factory employs 110 people.

The factory's headquarters are on the Matsu Islands. Moreover, they have distributors in Neihu, New Taipei City, Taichung, Taoyuan, and one distributor in Mainland China. In Taiwan, their sales offices are in Nangang, Dogying, and Taipei.

4.4 Value Propositions

Quality is a core value of the Matsu Liquor Factory. The cold climate of the islands, the water seeping from the granite rocks in the tunnel, the thought given to the selection of the sorghum, all combine to the production of a quality liquor. Moreover, the factor relies heavily on experience, prioritizing the knowledge left in heritage to them by their ancestors. Besides, the liquors are often left to age for years inside the tunnels, rendering their taste more unique. Customers can count on a product that is natural and authentic.

4.5 Distribution Channels

The liquor factory mainly markets their products through their distributors in Taiwan and in Mainland China, and specialty stores scattered throughout the Matsu area. Locals buy directly at the factories. Matsu liquor can also be purchased at Carrefour, Px Mart, and convenience stores like 7/11.

4.6 Customer Relationships

At the beginning, the liquor factory was an OEM, selling their products under different

brand names. Because they focus more on branding nowadays, they have decided to put greater emphasis on customer relationships. In the Matsu area, the company is well established and appreciated. Their employees and main customers are local people to whom they also sell the red yeast that is a by-product of the wine making process. Locals get preferential prices, paying 40% less than the price paid by buyers outside Matsu.

4.7 Customer Segments

The company targets mainly Taiwan markets. Their main customers are the people living on the Matsu Islands. 90% of their customer base are in Taiwan. The 10% left are in China, most of them in the Fujian region. Currently, a large share of their customer base is between 45 and 55 years old, and they are mostly male. The company strives to appeal to young people and women. To reach this goal, they have released a liquor containing only 40% of alcohol targeted particularly at these two groups

4.8 Cost Structure

Given the factory's business model, the most important costs are incurred by labor, brand building, advertising and product development. Every year, the company spends 8 million on advertising of which half serves to grant sponsorships to promote their products and 2 million are targeted at the Fujian region in China. The company also advertises through Facebook, Instagram, television and other media.

As for product development, the company needs to innovate constantly to maintain awareness and appreciation of its brand. Product development incurs significant costs and high risks. The new product may or may not be well received by the public. It is a gambling where wins are almost as likely as losses. In the long run, however, innovation is a wise investment as it secures the company's place in the markets.

4.9 Revenue Streams

The company earns revenue from selling their different kinds of wine. The most aged liquors are the most expensive. Matsu residents pay cheaper prices for products in exchange for accepting simpler packages. Every year, the company's revenue average 500 million.

5. Branding

Kaoliang liquor brand is actually the cornerstone of the business, geared toward reaching a wider audience. It helps people know and remember what they are consuming. Besides, people mostly get attracted by the brand expression, originality, identity, design and the uniqueness of the product. The brand's essence is expressed through its look and voice which gives it a daily opportunity to celebrate its true nature. At first, Matsu liquor was implemented

to give a warm emotion and a revival energy to the soldiers in the island, who stand steadily on the front line, protecting their territory. Hence, the wine production reflects the heart of each soldier, the desire of victory. Matsu Kaoliang must develop its own identity based on the territory where it is produced, its military history and other particularities. The identity can also be based on the wine production itself or what it represents for local people's living standards. Environmental and quality certification could be a huge part of the brand identity. The packaging and all forms of advertisement must emphasize this identity.

Kaoliang Liquor is considered one of many people's favorite past times, they enjoy it on different occasions for example; in a relaxing dinner, a celebratory toast, a night out with friends, a sunny day at the beach etc… Thus it tends to define the contours of social gatherings which is one of the perfect ways that the brand can reach the ears of people who never step their feet in Matsu to purchase this specific brand of liquor. There are so many other ways that Kaoliang brand liquor can grab the attention of the international market including young people, new taiwanese and foreign customers.

5.1 Exposure (Social Media Marketing)

With so much competition in the liquor industry for the attention and resources of the customers, it is necessary for the Kaoliang liquor industry to stand out and prepare, as a consequence, to enhance their communication strategy, impacting who matters through advertisements on social media. Therefore, emphasize on a good content marketing strategy by strengthening the presence of Kaoliang liquor with its website, which involves adding some new videos of the Kaoliang making process and new other value added to the website content to make it more attractive or even pay for more advertisements in search engines. One of the main concern is that the page of Matsu Kaoliang liquor appears among the main results when an user enters a specific key word about liquor so that people can see the brand anyways and perhaps would like to know more about it because nowadays, people, especially the youth, spend most of their time on social media.

5.2 Using Public Figures to Promote The Brand

People admire public figures a lot and tend to be curious about their lives, how they spend their time, their favorite things such as skin care products, food, brand (clothing and also drinks) and so on…Once they know, they often want to use or experience the same thing. And the public figures have many followers, the world knows them and they have a great impact in people's lives. This is the reason why public figures can play an important role in marketing and increase the demand for Matsu Kaoliang liquor. Matsu liquor industry can pay a public figure of high influence to advertise Matsu Kaoliang liquor through their activities. The public figures

could be anyone in a position of persuasive power and influence such as government official, politician, movie star, sports hero, singer and so forth… That, can drive a lot of attention to Matsu Kaoliang liquor.

5.3 T-shirts Marketing

T-shirts are another way to promote Kaoliang brand liquor. They have become an important part of the marketing promotion and brand awareness that marketers use to attract customers. That can be considered as a boon for the industry and can simply work under a tiny budget, so Matsu Kaoliang liquor factory can take the brand to the masses, using this marketing tactic. The industry can take advantage of people's liking for these clothing by putting advertisements on them, in this way people wearing these kinds of T-shirts become like a walking billboard ad for the brand. This strategy is all about selling Kaoliang brand by using T-shirts as a means of advertisements. In this method, the advertisement design needs to have an image, message or a slogan that point out the greatness and the identity of Matsu Kaoliang liquor. Having such T-shirts in stores or in crowded places would be a great asset for Matsu's industry because people pay attention to what is on a T-shirt and that can nurture their curiosity which can make them want to discover this famous liquor of Matsu. If done properly and in a strategic way, those T-shirts can generate brand awareness among the target customers.

6. Packaging

The package design of Matsu liquors would have a great influence on the customers. Therefore, the liquors should be sold in a unique package as the uniqueness of the liquor itself. Since Matsu has a great story behind the liquor's existence, so having an original package that implies the purpose of its creation would make a big difference in the foreign markets because it will, not only, express the beauty of Matsu's history but also attract more customers and tourism to Matsu Islands.

6.1 Package Design

The design can embrace the representation of Matsu's statue, Taiwanese soldier and the rice leaf symbol. Connecting these three components will give a rise of Matsu's best quality Kaoliang in Taiwan and also in the international market.

7. Strategies for Reaching International Markets

The Kaoliang liquor from Taiwan's Matsu Liquor Factory Industry Co., Ltd. has been praised at many international spirits competitions in recent years. One of their products containing 58 percent of alcohol won the Grand Gold Quality Award at Monde Selection 2019 in Brussels. However, although the Matsu Kaoliang is widely consumed in Taiwan and in

China, it has yet to become popular abroad. Nonetheless, it constitutes a promising industry due to the water quality and special production. In 2017, County Commissioner Liu Tseng-ying called for the distillery to double its revenues and profits. Currently, the distillery's operations yield NT$500 million per year. To increase sales, Matsu Kaoliang will have to compete against the more famous Kinmen Kaoliang, which holds an 85 percent share of the domestic kaoliang market, but also face the steadily decreasing consumer demand. Consumer preferences have changed due to globalisation and many people prefer imported western wine. Younger consumers do not know a lot about Matsu kaoliang. Moreover, competition comes from Chinese liquor makers who have opened shops in Taiwan where they sell at slightly cheaper prices and with appealing packages. Matsu Kaoliang has first-comer advantage but must design strategies to attract younger demographics, improve the brand image and reach international markets. The global wine and spirits market is highly competitive and it may be difficult to become a household name internationally. However, there are some strategies, based on research and big companies' success that can be used by the Matsu distillery (Mora, 2007).

7.1 Market Segmentation

Market segmentation is important. The county must not try to reach all markets at once but identify key countries where the product could be well received. Once this first step is completed, they can target these markets through media advertising or participation in competitions in these countries, and partnerships with local distributors. A niche-logic is, then, applied, further segmenting the markets based on demographics and experience with sorghum wine.

7.2 Distribution Channels Expansion

Successful wine companies have been known for numerous mergers and acquisitions. While this may be outside of the financial means of Matsu distillery, the principle still stands. The idea behind this practice is to get closer to the targeted consumers. Expanding distribution channels is a necessity to enter international markets. It is necessary to investigate the major points of sales in the targeted market and design a strategy to reach them.

7.3 Diversification and Value-adding Strategies

Being different should not be limited to the brand identity but also includes its diversification and value-adding strategies. The Matsu distillery must innovate and provide consumers with as many choices as possible. On the other side, Matsu islands have a lot to offer, which gives endless possibilities for collaboration with the Matsu distillery. One effective value-adding strategy could be to sell the kaoliang along with exotic red yeast treats.

7.4 Communication Strategy

Lastly, while online alcohol selling is illegal in Taiwan, the internet can still be used to promote the product domestically and internationally. Alternative methods of communication could make a huge marketing difference. These may include product placement through TV programs or Taiwanese youtubers with a significant following base, and associate a particular liquor flavour with a famous persona, perhaps from the Chinese Civil War.

8. Target Audiences

Domestic target audience: The first target group for the Matsu Kaoliang must be the soldiers who live on the islands on a more regular basis. This can be extended to the ones who spent time on the island, perhaps for their mandatory military formation. The county can encourage them to come back with their family to enjoy the local wine. Another audience could be young people who are interested in their country's history.

International target audience: South Korea is the obvious audience because apart from China, it is one of the rare countries where the Kaoliang is produced and thus, a market already exists. Otherwise, the product can be appealing to anyone who is interested in war and military history. The county must insist that Matsu and its wine are displayed on Taiwan's brochure, making it a necessity of Taiwan's experience for visitors.

9. Competition

The direct competitor of the Matsu liquor is the Kinmen Kaoliang Liquor Inc (KKL). The company provides more than 1,000 jobs. In 2010, the company earned a revenue of NT$11.8 billion (US$400.9 million). They sell an average of more than 40 million bottles annually.

Diversification can partly explain the success of this rival. They sell skincare products including a whitening and moisturizing mask and a facial gel, made from kaoliang extracts. Having your brand name on different products makes your brand name more recognizable. Moreover, the good quality of one of the product types will positively influence the perception of another.

10. Conclusion

The Matsu liquor factory has been around for over 60 years. It has gained experience and its products have received praise from experts. Matsu Kaoliang is a high-quality, unique product that could occupy a profitable niche domestically and in the international markets. The company's executive team chose to focus on Taiwan markets for the foreseeable future. To increase its profits, the Matsu Kaoliang must propose something different from its competitors, reach new consumers across demographics and diversify its catalog. Some foreign countries

like the United States where tariffs can be as high as 80% may not be an option. However, neighboring countries such as Japan or Korea can represent a profitable venue. Reaching international markets will necessitate a step-by-step plan that starts with selecting a few target markets and reaching foreign distributors in these areas. Succeeding in today's world requires tech-savviness and boldness. The company must not hesitate to harness the power of the internet, use strong advertising and lean on their strengths, which are the military history, the cuisine and the overall exotic features of the islands that can all contribute to build an original brand.

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Value Co-Creation of CeEF (Celestial Elites of Formosa) Branding to Specialty Tea

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Abstract

The latest "Taiwan Tea Industry 3.0" policy advocates a two-track progress of “specialty tea" and "commercial tea", marching to the goal of "shaping the fashion and culture of oversea tea industry". At the moment while Taiwan tea is flying into global market again, this essay based on the brand value co-creation process of the "Celestial Elites of Formosa" (CeEF, 天萊嚴選) to launch a case study on highlighting consumers’ participation design, combining regional brands’ characteristics, "integrate utilizing" to an overall output of Taiwanese tea culture and unifying international tea tourism of estate-grown tea as pioneering efforts. Through action research this paper hope to trigger an interactive dialogue to cope with the policy propositions.

Keywords: *value co-creation, tea tourism, specialty tea, brand, tea estate*

1. Branding Value System of CeEF Storyline

The purpose of CeEf is derived from an original intention of "God bless Penglai (蓬萊, Taiwan), Treasure Island Elected." Carefully selected by CeEf's tea business takes responsibility of Taiwan specialty tea as its only one mission. This article starts with four branches of storyline to trigger a chain effect of beautiful mountains, clean water, and magnificent teas extended to tea-banquets all over the world through value co-creation (VCC) with branding communities. In short, CeEF brand story has been built on four dimensions of Tian (天, heaven God), Terroir (地, land earth), people (人, human arts), and Hui (會, exchange meeting) etc., that four aspects interact with each other and come into a set of brand value system described separately below.

2. The Tian Elements of CeEF

First, introduce the key element of "Tian", it refers to the unique weather condition of Taiwan which is mediating between surrounding seas and numerous mountains, and known as "Minnow Island" (鯤島) where is the birthplace of Austronesian People exactly like a giant whale. Miraculous circumstance gifted exotic, wild and native species of Formosa tea trees emergence, which has bred and evolved 24 tea plant varieties certificated officially through Tea Research and Extension Station (TRES) naming development since 1969. On the one hand, these 24 varieties give multiple choices of Taiwan tea from wild to tame of breeding technology; on the other hand, it also determines the processing suitability of various teas as the most critical value orientation (Wang, 2018). In light of Tian, artificially planted tea varieties just like paper mulberry trees called "commensal species", which are closely to be witness to the Austronesian People for their genes as slices of history (Chang et al., 2015). In sum, Tian's VCC could be focused on following issues:

VCC Indicators: temperature difference, wind, airflow, rainfall, humidity (mist)...etc.

Thematic Brand Story: the breeding of 24 tea plant varieties in TRES.

Symbolic Objects: the morphology of 24 varieties' characteristics as commensal species.

Product Index: the processing suitability of Taiwan tea.

3. The Terroir Elements of CeEF

Second, describe the key element of the Terroir. Nearly 181 high mountains above 3,000 meters' altitude densely distribute on Taiwan island tissues five major mountain ranges including the Central Mountain Range (the tallest peak is Xiuguluan Mountain, 3,805 m), the Xueshan Range (the tallest peak is Xueshan/Snowy Mountain, 3,886 m), the Yushan Range (the tallest peak is Yushan/Jade Mountain, 3,952 m), the Alishan Range (the highest peak is Datashan, 2,663 m), and the Coastal Mountain Range (the tallest peak is Xingangshan, 1,682

m) etc. Interspersed among these magnificent mountain ranges, there are also 118 officially governance rivers, such outstanding geographical environment has breaded a unique style of Taiwan tea in world class. They are basic components belonging to Terroir (地話) category gaining value through different geographical indication system like AOC, AOP or IGP etc. (Chang and Hsu, 2017). For instance, “mountain plots” (山場) and “rock flavor” (岩韻) have been highlighted among the affective factors of tea quality and price structure (Xiao, 2016), progressive research found that different rock areas had different formation of tea quality dependently (Chen and Yang, 2016). In short, Terroir VCC focused on following issues:

VCC Indicators: mountain plots, rock flavor, earthy charm, environment, hydrology

Thematic Brand Story: terroir features of different Taiwan tea areas

Symbolic Objects: Images of mountains in Taiwan tea areas

Product Index: terroir feature expression to the tea areas

4. The People Elements of CeEF

Next, introduce another element of people. Looking back on the worldwide Formosa oolong tea since 1869, Taiwan tea experienced five generations of inheritance and evolution about Fanzhuang (番庄) tea, Baohua (包花) tea, Baozhong (包種) tea, Dongding Oolong (凍頂烏龍) tea and Qingxiang Oolong (清香烏龍) Tea etc. (Ye, 2016), still standing firm in the international market. Those folk craftsmanship has been integrated into 8 types of Taiwan specialty teas (Yang and Qiu, 2018) and representative popular around the world. In 21 century, Taiwan specialty tea has stepped down from philosophy of body intuition to tea science (Omori, 2019) and even a delicious science of Gastrophysics (Sato, 2020). In sum, people VCC could be focused on following issues:

VCC indicators: tea technology, tea craftsmanship, tea science…

Thematic Brand Story: 5 generations of Taiwan tea development

Symbolic Objects: portraits of Taiwan tea master like as “Father of Formosa Oolong tea,” John Dodd and Li, Chunsheng (李春生); “Father of Taiwan black tea,” Arai·Kokichiro (新井耕吉郎) and “Father of Taiwan tea,” Wu, Chen-tuo (吳振鐸).

Product Index: 8 kinds of specialty Taiwan tea and the Age Tea (老茶).

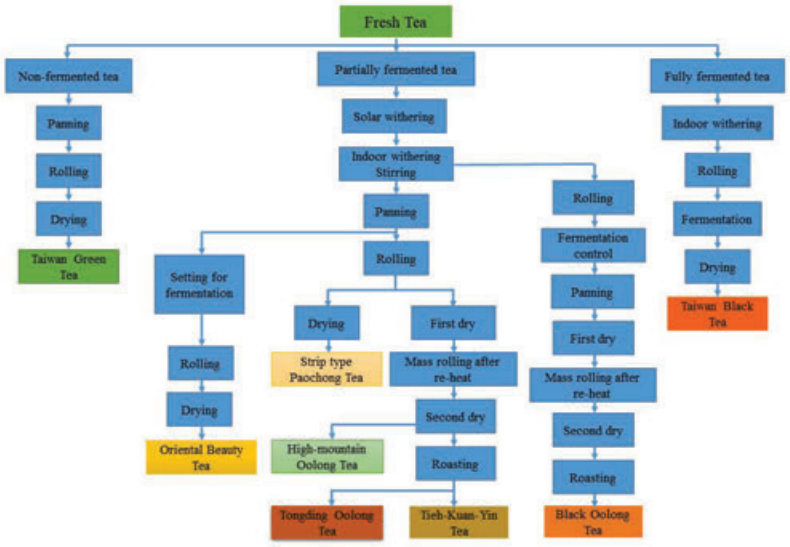

Figure 1 8 types of Taiwan specialty teas and producing procedure.

5. The Hui Elements of CeEF

Finally, explain the element of “Hui”. Its concept comes from the "one time, one meeting" (Japanese "Ichi-go ichi-e") tea ceremony, which basically emphasizes "tea party" of value creation for all tea-related products can be more valuable through tasting, competitions, tourism and exchange, CeEF start with Hui on the perspective of “service” than “marketing” (Rust and Huang, 2014), from the brand community "meeting" to multiple value co-creation (Ind et al., M. 2013), e.g., O2O branding co-creation interplay with online and offline brand communities (Hajli et al. , 2017). Taiwan Tea Assortment and Grading system (TAGs) for International brand-establishment of organic tea flavor characteristics, production history, and improvement of tea Grading system (competition), pushed the flavor wheel system developed in this field (Chen, 2021). On learning world-famous wine appraisers and appraisal system lead wine & ingredients sold together, restaurants must-have and well-documented labels service (Chen, 2012). Alternative agro-food networks (AAFNs) shifts to place-based and embedded operations to high-quality agricultural products choices of consumers. The concept of local food systems includes social embeddedness and place-orientated embeddedness on the social, economic, and ecological influences of the “place”. Through the uniqueness of the place, it enables and constrains food production and consumption on the trust of social relationship between producers and consumers among natural, cultural, and historical factors. AAFNs involves a social construction of quality food including face-to-face, proximate, and extended network types (Parrott et al., 2002). The product and the place are two most important strategies of quality construction between producer and consumer relationship, while face-to-face network is more focused on the former as the farmers’ market, the extended network is the latter as certification of the place of origin. They can also coexist just

like a transaction between producer and consumer on the original production place or the local products of certificated sales, etc. (Liang, 2014). In short, Hui VCC focused on following issues:

VCC indicators: tea parties, tea tourism, tea Expo.

Thematic Brand Story: estate-grown tea with TAGs

Symbolic Objects: tea props, TAGs, brand mark, flavor wheel

Product Index: local tea and ingredients together with AAFNs

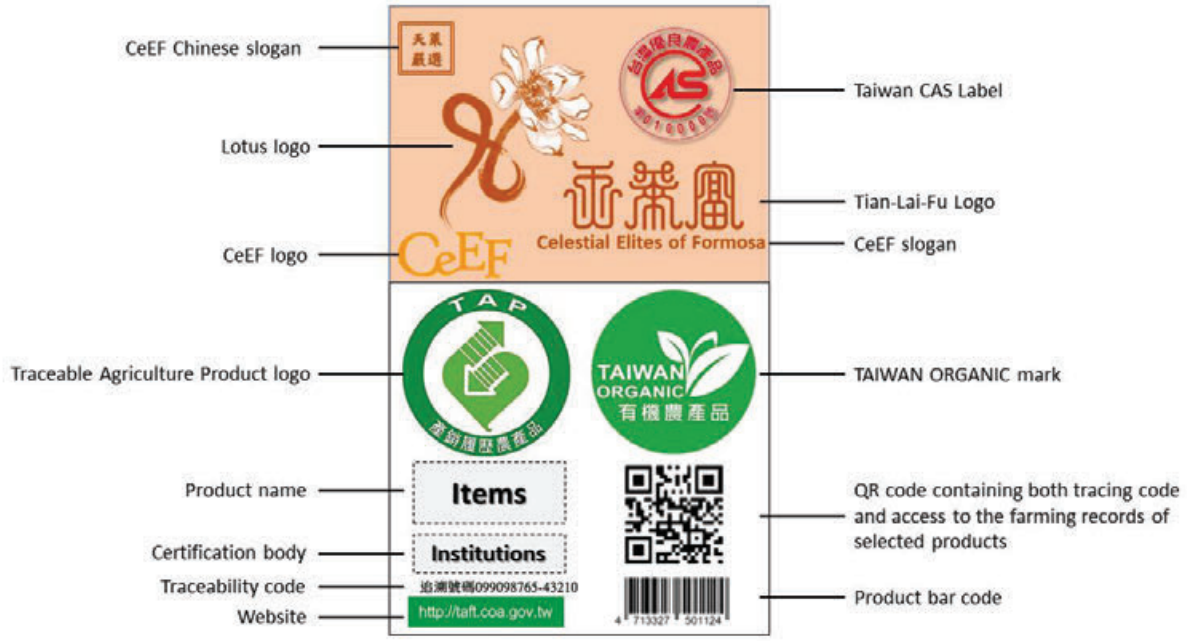

Figure 2　CeEF trademark and product label design for IoT era.

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Study Indian Brands of Wine Making into Global Arena - An Analysis

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Abstract

Branding is a way of identifying a business. It is how customers recognise and feel your business. A good brand is more than just a logo — it's projected in everything, like from style of customer service, the way of making product, uniqueness of the product, business model one follows, the way marketing materials are designed and, the model of distribution followed in making product available for consumption or use by final customer.

Because of Globalization and Internationalization, the competition in the wine world has raged a fierce race. Quality has raised full circle on all fronts of this product of time immemorial history and legacy. Many new countries are producing new wines and branding the local, traditional wines and exporting to different parts of world.

The International market today is demanding for only the best of best in the wine. Building a brand is a herculean task and plays vital role in any wine market globally, where the consumer is bombarded by flood of choices. By Building a strong brand, a company can enjoy increased revenue and greater market share. In international markets, the importance of branding in the wine industry is proliferating day by day. France, Italy and Spain are only a few of the countries which have developed strong brands.

This paper aims to understand the rise of one of the Indian brand “Sula wines” as a global brand and struggle of a local wine to be a global brand from India.

Keywords: *Consumer, Brand, Wine, India*

1. The Indian Wine Industry

Exposure to new cultures, growth in foreign tourists, overseas education, and rapidly changing demographics are driving wine consumption in India. Despite high tariffs, wine imports registered 14% growth (by value) from 2017. The number reflects the evolving Indian consumer palates over the past decade, encouraging many international winemakers to expand their business to Indian territory.

With a young population, increasing urbanisation and the perception of wine as a 'status choice', India has parallels with other Asian markets where there is a growing acceptance of and preference for wine among the upper and middle classes. As Indian cities attract greater numbers of increasingly sophisticated residents, exclusive wine bars have emerged and the number of restaurants and higher-quality hotels have increased.

The number of wine importers in India has been estimated at between 50 and 100 over the past few years. The five largest importers account for around 60% to 70% of imports, with the balance of active importers, perhaps 30 firms, each handling fewer than 10,000 cases per year. Several importers started as distributors of alcoholic beverages other than wine and subsequently added wine to their portfolios. Additionally, some Indian wine producers who seek to offer their customers a full range of options are importing wines that complement their domestic production.

In 2018, India imported 5.2 million litres of wine with an admittedly low value of US$27.4 million (approximately A$40 million). The country imported approximately 550,000 cases of wine, an increase of 75,000 on 2017. While there is a strong market for bottles priced below A$30 at retail, high duties and taxes on imported wine mean importers ideally look to pay a low FOB price - around A$2 to A$3.50 FOB per bottle.

The largest exporters of wine to India are Australia, Spain, France and Italy, who combined supply almost 75% of the country's wine imports. Secondary exporters include Chile, South Africa and Argentina. The European Union previously supplied over half of India's wine imports yet over the past two years, Australia has surpassed the EU through more competitive prices and lower logistical costs.

Based on trade sources and available sales data, national wine consumption is over 30 million litres per year. Most of India's wine consumption takes place in urban centres, including Mumbai (32%), Delhi (25%) Bangalore (20%), Pune (5%) and Hyderabad (3%). At present, consumers have a strong preference for red wines followed by fortified, white and sparkling wines.

The hospitality sector (hotels, restaurants, catering, clubs and pubs) has a larger market share than the organised retail sector, as the Indian Government allows hotels to import alcohol duty-free (equivalent to 5% of the average foreign exchange earned). This means

much of the imported alcohol consumed in India is in five-star hotels in major cities.

Wine's softer image has also made it more attractive to female consumers. Indian women view wine as classy, healthy and a socially more civilised drink to be seen drinking among family members. These trends suggest a dissolving of social taboos and cultural inhibitions related to alcohol especially for women, and wine is increasingly viewed as an acceptable drink within Indian society.

India has its own domestic wine industry too, with Sula Vineyards and Grover Vineyards among the top Indian vineyards and wineries. Collectively, they have 90% of the market and are perceived as 'better value for money'.

In a country with a population of 1.4 billion and here around 750 million people are above the legal drinking age and the number is growing by an average of 19 million a year. India is a booming market with many opportunities for wine makers across the world.

2. Big Barriers

Alcohol sales have been problematic for certain state governments in India for some time. Alcohol is banned in Gujarat, Bihar, Nagaland, Mizoram, and Lakshadweep, with additional restrictions in many other states.

Each state government controls the taxation, distribution and sale of alcohol. Brand/label registration is mandatory for the brand to be sold in the respective states. Separate licences are required to produce, bottle, store and sell all liquor products. Alcohol advertisements are also banned, making it hard for companies to promote their brand(s) directly.

For winemakers the customs duty on wine is 150% on cost, insurance and freight (CIF). Thus, the final cost to the consumer is around 9 to 11 times FOB in Mumbai, around 7 to 8.5 times FOB in Delhi and around 6 to 7 times FOB in Bangalore.

Despite the sector's accelerated growth over the past few years, wine penetration is still low with an estimated two to three million consumers consuming 24 million litres.

3. The Story of Sula Wines

The Story of Sula Wines: Sula Vineyards from Nashik (Maharashtra, India), who changed the face of Indian wine industry and made Sula Wines one of the successful brand in India as well a s International market, This is a pioneer brand which has not only changed the consumption pattern of Indian alcoholic- beverage market but also created a new market for wine in India. This case proves how a well designed and implemented brand strategy can make an zero demand product a high demand one. Sula Vineyards is the market leader in sustainable wine making and it has created huge employment opportunities for thousands of rural youth locally. It has positioned itself internationally as the best wine producer from

India. The research and analysis of mindset of consumers and building a appropriate strategy to accept the new product has been pivotal in the success of the brand.

Sula Vineyard's meets on a regular basis to discuss on how to maintain the market leadership as premium wine producer from India. At their Sula Fest, an annual two-day event pairing Sula wine and Indian food with marathon series of rock concerts under the stars. Rajiv Samant and Kerry Damskey, Sula's co-founders, held high expectations for Sula's expanded portfolio of single-varietal brands as they continued to achieve high market-growth rates, all of which would require more consistent quality and quantity of grapes from both owned and contract Vineyards.

To deal with expected rapid growth, the management has invested more on facilities like wine making and wine tourism which is a major step in growth of the brand.

The identification of these gaps they started first planting of grapes in 1996, and since then the company's target had been India's emerging quality-wine consumer for its premium wine.

As the popularity of Sula's first vintage, sales roared up, and the company was on its way to becoming the number one. Sula has made a growing Indian wine market being integral part of this astounding growth. The team of founders had used their knowledge in building the marketing strategies to stimulate market demand both domestically and internationally. Despite many challenges from 2008 to2010 Sula moved aggressively into sustainable wine operations with a number of costly, but effective investments in organic agriculture and following best of market technologies to reduce energy consumption and water conservation, all of which are important in grape growing and wine production.

Sula's Strategies: The decline of Global recession by the end of 2012, Sula has implemented several diversification strategies which included activities on distribution of beverage and hospitality. Sula has developed a very extensive distribution network for wine imports and other alcoholic beverages.

In 2012, Sula opened a 32 rooms beyond its Vineyard facilities, to support extended visitor stays. It provided abroad variety of facilities for visitors just 3 k. away from facility. They have provided balcony for guest rooms, which has spectacular lake and hill view. More facilities like Conference hall, Gymnasium, Café, Spa, Gaming rooms etc for Guests to chill out.

Sula opened wine and tapas bars, in India's big and happening cities like Mumbai and Goa and has plans to increase their presence in tier II cities like Chhattigarh, Orissa, Jammu, Kashmir and tier III cities like Nasik, Baroda, Trichy, Madurai across the Indian subcontinent. Sula has 65% market share and is also exported to 30 countries. Sula is also a pioneer in wine tourism in India, which has opened countries first Tasting room at a winery in 2005.Sula had

more than 2.5 lakh visitors since last few years. Company's Sula fest is one of the most awaited music festival in India.

Sula Vineyards recently won the prestigious Drinks Business Award 2016 for the 'Best Contribution to Wine and Spirits Tourism'! This is the first time an Indian company has won a Drinks Business Award.

Firmly committed to remaining at the forefront of Indian wines, Sula continues to experiment with new varietals, engage in sustainable agriculture and support the local rural economy. Sula is well on its way to becoming one of the world's most sustainable wine producers.

In addition, the company is also a leading wine and spirits importer, with Sula Selections, a portfolio of prestigious brands like Remy Cointreau, Hardys, Ruffino and Asahi. For information on the entire Sula brand portfolio.

Sula wines achievements: On September 19th, 2016: Sula Vineyards, India's #1 wine company raises a toast to celebrate the grand achievements at the first edition of the 'delWine Excellence Awards' - Sula bagging three awards to its fame. The company was nominated in three categories and won all three!

4. Awards

Indian Wine Producer of the Year - Sula Vineyards

Wine Tourism Winery of the Year - Sula Vineyards

Indian Winemaker of the Year - Ajoy Shaw

The winning awards were decided via public vote. The highlight of the evening was a 'by invitation only' Wines of the World (WOW) showcase, where guests were able to taste more than 120 wine labels including wines from Sula Vineyards and also Sula Selections - the company's import arm for wines and spirits. The award is an initiative to celebrate and recognize people and companies in wine in India for their contribution to the growth and success of the Indian wine industry.

Sula Vineyards also discovered Dindori as a wine making region, and this region is today regarded as having the best terroir for producing wine in India. Sula Vineyards recently won the prestigious Drinks Business Award 2016 for the 'Best Contribution to Wine and Spirits Tourism'! This is the first time an Indian company has won a Drinks Business Award.

Firmly committed to remaining at the forefront of Indian wines, Sula continues to experiment with new varietals, engage in sustainable agriculture and support the local rural economy. Sula is well on its way to becoming one of the world's most sustainable wine producers.

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today regarded as having the best terroir for producing wine in India.

5. Conclusion

Sula wines is a perfect example to showcase how branding strategies help becoming a market leader in Winery industry, in fact today Sula is one of the best brands of wine on the world wine platform.

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Agri-Products International Branding-Complexities and Challenges

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Abstract

Branding an agri-product in the producing country is a real challenge and success of branding lies in obtaining a space for the product in the minds of the consumers. International branding is still complex as the consumers to be targeted in the market belongs to different cultures and eating habits. It is a known fact that branding adds value to the product. It is seen that most of the agriculture production comes from small farmers. Hundreds of millions of populations in the world are living in poverty. The incidence of Covid-19 pandemic has hit the world and the entire farming activities are being disrupted. Farmers at local level find it difficult to get connected with urban markets and importing countries. The farmers suffer from loss of employment and income in this pandemic period. There is a need for rolling out relief and stimulus packages to put the agriculture sector in to rails. The emergence of shopping malls, hypermarkets, and super markets and the advances made in information communication technology make the consumers around the world accessible to variety of agriculture products coming from different countries. Branding increases value to the products and brand positioning presents the value proposition to the target market. This paper discusses the challenges and complexities in international branding in the present context.

Keywords: *Agri-products, Branding, Farmers, International Branding, Global Market*

1. Introduction

Branding needs to extend beyond the basic product. The American marketing association defines a brand as a name, term, sign, symbol or design or a combination of them intended to identify the goods and services of one seller or group of sellers and differentiate them from that of competitors. Branding refers to an art and foundation for marketing. Branding add value to the product. Brand positioning is a check against marketers who adopt a slothful philosophy of marketing me-too products to the consumers and against advertising that fails to add differential value to the product. Developing a differentiation strategy for the brand is a major challenge in brand building activity. International branding refers to the management of a brand in different regions of the world, intending to increase its strength and recognition in the markets in which it operates. Making a brand presence in local market or at national level itself is always a challenge and hence we can imagine the greater challenges in making the brand presence in global market where consumer preferences vary based on their culture and demand for the products. Globalization paved the way for accelerating movement of products across the borders by many marketers which were till then enjoyed by giant exporters only. With the opening up of global markets and the possible reduction of subsidies in the international market, any country can well emerge as a specialized food factory of the world, based on their local products branding. More over the developments in information communication technology makes it easier for the integration of the global markets.

While discussing about the international branding of agri-products at this juncture, the disruption caused by Covid-19 situation should not be neglected. United Nations in its report on impact of Covid-19 states that more than hundreds of million people all over the world suffer from hunger even before the virus hit. The incidence of Covid-19 has accelerated the sufferings and unless appropriate actions are taken, it may lead to a global food emergency situation.

Hence brand positioning of agri-products in the global market is to be targeted towards the affluent consumers in the society and without affecting the drive all over the world for reduction in poverty. The supply position is to be improved to meet the demands in the global market. This necessitates strengthening the farming activities by supporting farmers in debt restructuring in the post-covid situation as the availability of funds and its deployment to address the liquidity shortages and free up fiscal space is very crucial especially in the developing countries.

As regards to branding of agri-products the complexities and challenges are many due to its specific nature compared to other products. Branding is a marketing strategy for competitive advantage. Developing a successful strategy for marketing at local level itself is complex. Then as regard to international branding, the major challenges include not only the

one relating to spreading the wings at global market place but also on making additional decisions about the identification of marketing approaches to fit into the global market place. Seeking an opportunity for differentiated positioning by offering unique benefits of the brand becomes more complex as regard to agricultural produces.

Brand building in the international market by overlooking the priorities of the consumers are likely to end up in failure. Recent trends in technological developments and transportation facilities produced food surpluses and enabled consumers to obtain agri-products from the furthest reaches of the globe. Usually, it is noticed that buying most of agri-products directly from farmers is limited to the local level only. But the emergence of supermarkets, hyper markets and shopping malls provides selections of farm produces from thousands of farms from around the world. The marketers have to balance the cost with that of quality and price in branding the products for international branding.

Hence an appropriate marketing mix strategy is to be adopted while international branding is considered. Even though the marketing mix remains similar for both domestic and international market, international market is little more complex due to influence of external environmental factors such as cultural, legal and political. The complexity will also become more prominent with the evolution of consumer needs. This paper provides insights into the complexities and challenges in branding agri-products for international markets in particular.

2. Objectives

The main objective of the study is to get insights into the complexities and challenges while looking for international branding of agri-products.

3. Methodology

Due to the constraints impacted by incidence of Covid-19, the telephonic interviews with players at different levels in agriculture right from farming to the marketers are resorted to in addition to the published matter on the subject of study.

4. Discussion

Agriculture is the back bone of economic development in developing countries. The agriculture sector is always under pressure due to the rapid growth of population and consequent efforts in bringing down the level of poverty. Food security and safety are given prime importance and hence the whole world of agriculture is being directed towards organic farming. The three main pillars of agriculture sustainability are maintenance of a healthy environment, economic viability and social equity. The underlying principle is meeting the present need without any compromise in the ability of future generation to meet their needs. Now the border restrictions and lockdowns due to the wide spread of Covid-19 are disrupting

the agriculture sector by way of slowing down the harvesting operations in some parts of the world, leaving millions of seasonal workers without livelihoods, and also disturbing the supply chain activities ranging from farm to the food markets.

Food processing industrial units had to close down. The prices of agri-products were rising at a time when the access to them for the consumers were becoming difficult due to lack of sufficient money as a result of loss of employment and income on hand in the pandemic situation.

Another major challenge in undertaking agriculture farming activities relates to the loss in biodiversity on account of greenhouse gas emission as reported by international organizations. Their reports show that about one third of greenhouse gases come from food systems. Hence designing a food system needs consideration to the biodiversity maintenance also. Overcoming the challenges for international branding should begin from addressing those issues in the post covid scenario.

Agri-products branding strategies rests on the five pillars namely consumers, products, markets, resources and infrastructure, and developing countries should address each of these five elements. By leveraging the strength of the five pillars, globally competitive brands can be developed. Unlike other products the complexities and challenges for international branding of agri-products have some peculiar characteristics. As regard to the farmers, particularly small and marginal farmers, the post harvesting activities are to be focused on reduction in wastage and securing guarantees on sale of their products taking into consideration to its perishable nature.

The failure to sell on time leads to wastage of the harvest. Developing countries can enter export market with a portfolio of niche and mainstream products with long term value added. A well-organized set up remains absent as far as small farmers are concerned. This makes the presence of middlemen at various levels and they are becoming an intricate part of distribution system. Even though their contribution in the value addition process is negligible, they play a prominent role in price fixing and networking, sharing a very low margin to the farmers and retailers in the process. As mentioned since the larger chunk of the agriculture produces are coming from small farmers, they should not be deprived of the development benefits since they depend on farming for their livelihood.

Agri-products marketing techniques should be carried out in a professional manner at all corners of agri-business from the farming activities irrespective of the nature of the farm, whether it is a small farm or corporate farm. Marketing campaigns for agri-products with organic label will be more effective among affluent consumers.

India stands second in the Gross value of agriculture production where China is at the forefront among other countries in the world. It is also a fact that the rural economy is mostly

depended on agriculture sector and also major share of agricultural produces come from small and marginal farmers. The major challenge is originated from this point of farming. The problem starts from the time of planting itself as the quality of planting materials and the care given until cropping such as application of maneuver, water, climatic conditions and the impact of natural disaster. This has a bearing on the achievement of consistency in quality of products. The issue pertains to how brand building can be successfully carried out without consistency in quality of the produce even though sorting and grading are put in place. A major concern of the farmers includes level of crop yield and protection against pest. The pre-harvest factors influence the post-harvest behaviour. The quality of produces from different plants grown in different pieces of land also varies. It could be seen that the real farmers get a small percentage margin out of agri-business and they also lack protection against price fluctuations. Pricing is a major problem faced, by small farmers in particular, during the normal crop season and bumper crop season.

The next major challenge is the consumption patterns of the ultimate consumers targeted in international market. Consumers of agri-products from different regions and countries as well as different cultural and socioeconomic backgrounds tend to purchase different products. In India, being a federal country with different states, the consumption pattern is different in different states which points to greater challenges when the products from India are targeted to international market. Same holds good for other countries intending to position their products in international arena.

Global supply chain forum supply chain management is the integration of key business processes from the end user to the original suppliers that provide products, services and information that add value for customers and other stake holders (Lambert, et al., 1998). Supply chain system has evolved very rapidly since 1990s registering an exponential growth (Burgess et al., 2006). Actors of all parts of supply chain system is impacted by Covid-19 pandemic. Branding is to be considered as an integral part in making a supply chain sustainable and profitable. Hence major area which brings challenges in international branding is supply chain, considering the shorter shelf life of agriculture produces compared to other products. It is seen that high value agriculture products like fruits and vegetables are more vulnerable to logistical problems. Logistics environment is constantly evolving changes due to changes in market behaviour, technology, competition and supply demand balance. The perishable agriculture produces makes the supply chain activities more sophisticated.

As regards to supply chain, post harvesting activities like storage, sorting and grading, packing and packaging, transportation and information sharing need keen attention in moving towards international branding. Efficient and smooth flow of knowledge and sharing process among supply chain partners help to improve the characteristics such as agility, adaptability,

and alignment in the process. It is reported that estimated post-harvest loss of fruits and vegetable is between 25 to 30 percent. A quick analysis of data collected at local level with in the limitations due to Covid-19 reveals that the major reason for losses in supply chain is related with grading and sorting of the products. This has a greater impact while going for international branding. Supply chain is one of the most badly affected areas in the Covid-19 pandemic situation. It is seen that a large quantities of perishable food crops and also milk was buried due to disruptions in supply chain and decline in consumer demand in the pandemic period.

Since supermarkets may try to increase the turnover of shelf space as regards to the food products and optimize sales, a major challenge is putting in place an ideal logistic system to deliver products as promised. This necessitates the strengthening of logistics system in the producing country considering the nature of agri-products. A successful integration between the farming and logistics functions is very critical. Storage under controlled atmosphere as regards to perishable agri-products is an important point in the supply chain to be taken care of as it is a major determinant of brand value and brand positioning.

Another important aspect of food supply chain management is food safety and traceability. Food safety refers to the assurance that food will not cause harm to the consumers when it is prepared and/ or eaten according to the intended use (Nurhan Unusan, 2005).The issues relating to the development of an effective and full chain Food Traceability System is a complex process that require an in-depth understanding of the real process in different perspectives such as economic, legal, technological and social issues (Bosona and Gebresenbet, 2013). International food safety interventions such as the Hazard Analysis Critical Control Point (HACCP), the Codex Alimentarius (2003), ISO 22000:2018, and the WHO Food Safety Strategic plan (2013-2022) emphasize the need to identify and rectify food safety inadequacies (France Ncube et. al, 2020)Traceability is a well-coordinated and well documented movement of product and documented activities associated with the product from the producer through a chain of intermediaries, to the final consumer(Bollen, 2010).

The trend away from traditional commodity trading toward ‘buyer-driven’ value chains controlled by large retail, food service or manufacturing firms had serious implications for the livelihoods of the rural poor. As global retailers such as Walmart and Tesco become increasingly dominant, the quality and traceability standards they impose on suppliers are making it more costly and complicated to enter the global food chain (Byerlee, D et. al, 2005).Packing and packaging forms an integral part while branding the product in the international market so as to ensure the products reaching safely in the hands of consumers. Attractive retail packaging can catch the attention of consumers towards the shelves in retail stores. The package varies from product to product. Highly specialized packaging design

allows the produce to breathe in the package. Environment friendly packaging can make the supply chain more competitive. Putting proper labelling is a regulatory requirement for smooth flow of products from producer country to the importing country.

A major constraint in international branding is that the products should meet the international standards and satisfy the expectations of the target consumers. The core value of an agri-product lies not on the physical product but the intellectual property of the brand owned by the country in which it is produced. There is another major challenge due to the inability of rural food supply to connect to the urban markets and importing countries. This results in price increase in urban areas and other importing countries where concentration of consumers is found. At the same time the price in rural area will be coming down. Hence getting connectivity with major buyers determines the effectiveness in branding and brand positioning in the global market.

There are certain agriculture products which are, traded in bulk with minimal processing, coming under the agriculture commodity. Tropical products exported by developing countries include, sugar, tea, coffee, cocoa and cashew coming under food category and others such as rubber, cotton under non-food category. Most of such products are undifferentiated. Product differentiation to some extend has been attempted for some of those commodities mentioned under food category and is internationally branded.

Most of the agriculture planning was mostly confined to traditional crops. But current markets for fresh products are becoming dynamic throughout the world and are evolving faster than the traditional crops like wheat, cotton and corn (Omar Ahumada and Reny Villalobos, 2009). Organic market is the fastest growing areas in the food industry and the double-digit market growth is resulting in short supply (Hamzaoui-Essoussi et. al, 2013).

New opportunities in processing agri-products are also emerging with the development of frontier technologies like Nanotechnology. Those products do not come under the food supply system, but find applications in therapeutic and medicinal use. One of the best examples is Nanocurcumin (A. Karthikeyan et. al, 2020). Curcumin (*Curcuma Longa*), commonly known as Turmeric, is one of the most wanted medicinal plant and a spice in Asia and has come to the keen attention in the recent past due to its variety of biological and pharmacological actions. It is grown in many tropical and subtropical countries of the world and extensively cultivated in Asia. But curcumin as such has low therapeutic effects. Recent researches have established its potential for nano range formulations of curcumin namely nanocurcumin which enhances biological and pharmacological benefits of curcumin. Another example of an agro-produce is ginger (Zingiber Officinale) which is a spice and also used in folk medicine. Ginger is of medicinal value due to the presence of antioxidants that can prevent stress and damage to DNA. The chemical compounds contained in the fresh ginger

help the body to ward off germs. Researchers can bring out formulations to tap the potential benefits of ginger. Nutraceuticals is an emerging area across the globe and it stands for medicinally and nutritionally functional foods and is considered as a food or parts of food which provide health benefits including prevention and treatment of disease. The nutraceutical products are originated from plants and there is wide scope in production and international banding. Many countries prohibit the producing companies to put the benefits of the products in the label as regards to health claims without a license and hence many companies were reluctant in obtaining the license due to the expenses and associated problems in obtaining patent for a natural product. But there exists immense potential in tapping such areas in the global market.

As regard to the production of fruits and vegetables, India stands at the topmost position, but processing for value addition is limited to only three percent of production. It is also estimated that 35 to 40 percent of the total production of fruits and vegetables are wasted and it is due to lack of adequate infrastructure facilities like appropriate storage facilities, ineffective cold chain and poor logistics systems (Viswanathan, 2006).

The fruits and vegetables exported should be free of contamination by the fruit flies. The gap in value addition and other constraints in the food supply chain system requires utmost attention which will make the exporting and international branding more successful by enhancing the supply of safe products to meet the demand with a favorable brand positioning and meeting the demand.

5. Conclusion

A brand which has already saturated with their share in the regional market and wish to grow, extending their product market in other countries could be the natural way to international branding. International branding requires a thorough planning on how the products are to be perceived by consumers at different parts of the world. Branding agri-products is not only an exception but also more complex due to its peculiar characteristics in achievement of consistent quality, perishability and also meeting the needs of consumers under the influence of differing tastes, preferences and culture.

As in the case of other products consumer research enables to position the processed and value-added agri-products in the global market with unique selling propositions. The unique selling propositions once used at the time of launching for positioning a product need not be kept always and it needs to be repositioned with change of time as warranted by the emerging situations, keeping the brand name unchanged. This is due to the fact that the perceived image of the brand does not belong to the product but to the mental perception of the consumers. The selection of unique selling propositions which can maximize the sales is the art behind it.

The decisions on marketing and advertising should come out of the brand positioning.

All the challenges described above reiterate the need for collaboration and knowledge sharing among players. Community supported agriculture will enhance the benefits to small farms. Unless a system approach is followed from the farming activities effectiveness in international branding could not be achieved. The branding of raw agricultural produce may be complex not only due to its perishable nature but also due to the fact that similar or competitive product by different names. There is immense potential in placing processed and value-added branded agri-products in global markets.

Niche markets can be identified by the exporting country based on the concentration of non -residents belonging to their country in other parts of world, to meet their needs based on the pattern of consumption. In such situations the major marketing efforts have to be directed towards brand building exercise to position it in the minds of consumers for bringing in loyal customers to the brand. Without the production of adequate quantity of agriculture production and supply, branding for international markets could not be successfully managed.

Hence, the first and foremost thing is roll out of relief and stimulus packages should be continued by the concerned governments to make the sector dynamic to meet the challenges at both national and international level. Major developments in technology open up new opportunities for preparation of nanomaterials which can be put to use for therapeutic applications using agri-produces. Multi product portfolio can be developed while attempting international branding of agri-products.

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Halal Certification Procedures and Suggestions to Provide High Quality HR for Halal Industry in Taiwan

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Abstract

Muslim consumers' culture is widely diverse around the world; daily necessities and services can push forward two-trillion dollars market economy worldwide. Countries such as Malaysia and Indonesia are the top of the economic ranking of the Islamic nations. For these past years, Taiwan has shown strong initiative to develop Halal Certification, in order to enter the markets in countries such as Malaysia and Indonesia. This research aims to use interviews to understand the process to get Halal Certification and talent demand. The result has discovered that the Taiwan Halal Integrity Development Association is majorly responsible for the certification, which does traceability system in the process, including the understanding of the entire origin, slaughter, packaging and etc., in order to meet the increasing needs of Halal Certification, especially for provide high quality human resource in manufacture, certification, sales channel, logistics and etc. THIDA will establish Muslim exporters association and Muslim e-commerce platform to actively promote Taiwan Halal certified products.

Keywords: *Muslim, Halal Certification, High Quality HR*

1. Introduction

In 2018, influenced by the moral consumer demand inspired by the Islamic faith, Muslims spent a total of US$2.2 trillion on food, medicine, and life, and this expenditure increased by 5.2%. It is expected to reach US$3.2 trillion by 2024 with a cumulative annual growth rate (CAGR) of 6.2%, of which Muslim spending on food and beverages is valued at US$1.4 trillion in 2018 and is predicted to reach US$2.0 trillion by 2024 (State of the Global Islamic Economy Report, 2020). The State of the Global Islamic Economy Report (2020) research pointed out that Indonesia's overall Muslim economy ranking has risen from the tenth place in 2018 to the fifth place in 2019. The study pointed out that Malaysia continues to strengthen its Islamic economic enterprise ecosystem, Malaysia has formulated Muslim-related regulations, promoted global certification measures for halal certification bodies, issued the first Islamic financial technology crowdfunding license, and launched a new Muslim-friendly hospitality certification Plan (State of the Global Islamic Economy Report, 2020). In response to the needs of Indonesia, Malaysia, and other countries for halal certification, for manufacturers who intend to enter the Muslim market, if they can obtain halal certification for their products, it will have a bonus effect. Therefore, the purpose of this research is to understand the current situation of Taiwan's halal certification process and the demand for professionals in professional fields related to halal certification.

2. Literature Review

2.1 The Reason for Halal Certification

The word Halal (لالح), also spelled hallal or halaal, is an Arabic word which means acceptable, allowable, and permissible (Akhtar, Sun, Ahmad, & Akhtar, 2019; El-Gohary, 2016; Olya and Al-ansi, 2018). The concept of ‘Halal’ is derived from the Quran and the prophet’s Hadith, which define it as permissible, lawful, and having no restriction according to Islamic Sharia Law (Al-Qaradawi, 1999; p. XXV). According to Muslim dietary regulations, animals must be killed by a person with Muslim identity. All meat means that all livestock must be slaughtered in the name of Allah by Muslims. It is forbidden to eat animals that are not slaughtered by the name of Allah. It is forbidden to eat poisonous snakes and beasts and lower animals, four-legged omnivorous or carnivorous animals on land, and birds of prey are also inedible. Herbivorous animals such as cows, sheep, rabbits, camels, etc., or docile poultry such as chickens, ducks, geese, etc. are edible, but they must comply with Muslim teachings and be humanely slaughtered before they can be eaten. Muslims are required to follow specific dietary laws that determine which foods are Halal (permissible) for Muslims consumption(Ahmad, Rahman, Othman, Abidin, 2017). Once halal certification is

obtained by a firm it is eligible to engage in halal business (Ali & Suleiman, 2018). The halal credential is particularly important for the processed foods, raw materials for the processed foods, medicines, etc. which are imported from abroad or produced by non-Muslims (Panzi, Man, Nawawi & Abu-Hussin, 2019).

2.2 Halal Certification Units in Indonesia and Malaysia

Indonesia has recently launched a master plan for the halal economy, to make Indonesia a major producer of the global halal industry by 2024. It is expected to pass national Islamic financial activities in 2024 to enhance the role of Islamic finance in promoting economic growth. The plan enhances Indonesia's role in halal tourism and strengthens the ecosystem of halal food and products. As the largest Muslim country in the world, Indonesia has a population of 240 million Muslims. All relevant ingredients and foods are imported. The demand for Halal halal food will only increase day by day (State of the Global Islamic Economy Report, 2020). The halal certification in Indonesia is managed through the "Lembaga Pengkajian Pangan Obat-obatan dan Kosmetika Majelis Ulama Indonesia, LPPOM MUI", a credible religious association among the people. Since the Indonesian government promulgated the Law of Halal Product Assurance No. 33 in 2014, the Indonesian government established the official halal certification agency BPJPH (Badan Penyelenggara Jaminan Produk Halal, Halal Product Assurance Organizing Agency). On October 17, 2019, Indonesia officially accepted halal certification matters under government management. BPJPH is the only legal and official issuing authority for halal certification in Indonesia. The validity period of the LPPOM MUI certificate has been disqualified on October 1, 2019.

Malaysia's current population is 32 million, and Muslims who believe in Islam accounts for 60%. In order to further strengthen Malaysia’s leading position as a halal center, the Malaysian government divides halal affairs into two parts. JAKIM (Jabatan Kemajuan Islam Malaysia) is responsible for halal certification affairs. The official Malaysian Halal Industry Development Corporation (Halal Industry Development Corporation, HDC) is responsible for the development of the halal industry. The State of the Global Islamic Economy Report (2020) report pointed out that Malaysia continues to strengthen its Islamic economic enterprise ecosystem, Malaysia has formulated relevant regulations for Muslims, and promoted global certification measures for halal certification bodies. In addition, Commerce International Merchant Bank, Malaysia's second-largest bank, has also increased loans to SMEs to develop the local Muslim economy. In addition, Commerce International Merchant Bank, Malaysia's second-largest bank, has also increased loans to SMEs to develop the local Muslim economy. Malaysia will adopt the Halal Sectoral Roadmap Implementation 2021 (Halal Sectoral Roadmap Implementation 2021). It is expected that by 2025, the revenue of

halal products will reach 41.6 billion Ringgit (approximately US$10.117 billion). Among them, 40 billion ringgit (approximately US$9.728 billion) comes from halal food, and the remaining 1.6 billion ringgit (approximately US$389 million) comes from halal medicines (Economic Perspective, 2021).

It can be seen that Malaysia ranks the highest in the global "Islamic overall economy", and Indonesia ranks fifth. These two countries actively legislate or implement related programs to increase the output value of Muslim economic business opportunities. In the organization responsible for halal product certification, halal certification authority BPJPH is responsible for the issuance of halal certification in Indonesia; JAKIM is responsible for certification in Malaysia. Due to the active promotion of Muslim economic strategies between the two countries, the two countries have a large demand for halal-certified products. In the future, they may become important countries for Taiwanese companies to choose to enter Muslim business opportunities.

3. Research Method

Islam follows the Koran and the Hadith. It is aimed at Christianity. Products that eat or touch the body must conform to Islamic teachings, that is, "Halal" and avoid touching unclean things. Taiwan currently has the Taipei Mosque and the Taichung Mosque, but they are not affiliated with each other. The priesthood of the mosque is equivalent to the role of a Christian priest, and a mosque can have multiple imams. This research aims to understand the current status of halal certification organizations in Taiwan, the certification process, and the training methods for talents in the halal industry chain. This research interviewed Taiwan's Taichung Mosque and Taipei Mosque, which have Muslim beliefs and religions, in order to summarize and summarize the organization and certification process of halal certification products.

4. Results and discussions

4.1 Each country has a dedicated unit for halal certification. In Taiwan, the Chinese Islamic Association is responsible for the certification of restaurants, restaurants, and slaughterhouses. "Taiwan Halal Industry Quality Assurance Promotion Association" is responsible for halal product certification

Various countries have specialized units for halal product certification. For example, in Indonesia, the Indonesian Council of Ulama is in charge of national religious affairs. Majlis Ugama Islam Singapura-MUIS, Islamic Religious Council of Singapore and *Jabatan Kamajuan Islam Malaysia*-JAKIM, Department of Islamic Development Malaysia are in

charge of national religious affairs, and all food imports require halal product certification.

At present, the main halal certification unit in Taiwan is the "China Islamic Association" which is responsible for the certification of restaurants, restaurants, and slaughterhouses. "Taiwan Halal Industry Quality Assurance Promotion Association" is mainly responsible for the certification of halal products. Among them, the "Taiwan Halal Industry Quality Assurance Promotion Association" has established a halal certification process and certification fee specifications with Muslim countries. Countries need to recognize each other's membership of halal certification organizations before they can import and export products. For example, Taiwan Halal Industry Quality Assurance Promotion Association has joined Jabatan Kamajuan Islam Malaysia-JAKIM, Department of Islamic Development Malaysia, Majelis Ulama Indonesia-MUI, Indonesian Council of Ulama, Majlis Ugama Islam Singapura-MUIS, Islamic Religious Council of Singapore, International Islamic Halal Organization-IIHO, KSA, International Halal Integrity Alliance-IHI, World Halal Food Council-WHFC, Association of Halal Certifiers -AHAC and other units are mutual organization members.

4.2 For companies to apply for halal-certified products, an internal audit team for halal products must be set up within the company

Taiwan's halal market-certified products are currently prone to confusion among consumers. Many stores or restaurants write "Halal" at the door and cannot guarantee that the products they sell must be certified. Therefore, when buying halal products, you need to name the certification mark issued by the official certification body to represent the real halal product. At present, Taiwan’s halal products exported to other countries need to be certified by the "Taiwan Halal Industry Quality Assurance Promotion Association". The certification process needs to do traceability management, that is, to understand the breeding process, slaughter, packaging, etc., it needs to be applied by the company and cannot be submitted through personal identity. After the enterprise attaches the for-profit business registration certificate, the association sends people to the breeding farm to inspect the field and the current status of the breeding. The certification process includes document review, on-site survey, deliberation (teaching staff must be present), and signing. In addition, the company needs to have an internal audit team for halal products, with members from the production department and warehouse management department. The overall audit team must be composed of technical personnel and Shariah personnel. The identity of the auditors may not necessarily be Muslims, but the Shariah must be a Muslim and have a degree in religion to be able to serve. Internal audit members need to have a clear understanding of the overall halal product certification process and precautions.

4.3 Cultivate halal professionals in production, certification, distribution, and logistics through courses

In response to the increasing demand for halal-certified products, it is urgent to cultivate halal talents, especially for professionals in production, certification, distribution, and logistics. In addition, there should be internal inspectors within the company to play the role of the internal control department and effectively master the breeding and slaughter procedures. Meet the requirements of halal certification.

Currently, the professionals engaged in halal certification mainly come from the food science-related departments, but their professional knowledge does not fully cover the needs of halal products. Taking the cultivation of talents abroad as an example, Malaysian overseas students will use halal certification-related research as the master's topic when they are studying in graduate school. Indonesia's MUI also cooperates with the local BOGOR University to cultivate relevant talents.

Training for top management and the managerial staff was also highlighted as important for effective implementation of the halal program (Ahmad, Rahman, Othman &Abidin, 2017). Therefore, Taiwan’s halal-certified talents are still awaiting assistance from production, government, and academia. For example, courses in the university food field, trainee programs, general education courses, etc., teach professional knowledge about Islam and halal products, and train halal-certified professionals.

4.4 The visibility of halal-certified products in Taiwan needs to be strengthened. The domestic sales part will increase the exposure of the sales channels; the export part will establish an export chamber of halal products and an e-commerce platform

Currently, the promotion of halal products in Taiwan is in its infancy. Although halal-certified products have been sold, the internal and external sales of products need to be strengthened.

The main sales targets of manufacturers are Muslims who come to Taiwan to study and travel. In order to let Muslims in Taiwan know of the stores that purchase halal-certified products, companies should strengthen their sales channels and expose them to increase domestic product sales. In addition, foreign countries don't know much about Taiwan's halal products. The Taiwan Halal Industry Quality Assurance Promotion Association plans to establish a halal product export chamber and a halal product e-commerce platform in 2021 to actively promote Taiwan's halal-certified products.

Furthermore, Taiwan has international standards in medical technology and hardware and software equipment. For example, Taiwan’s medical beauty products are very popular in

Indonesia. For the sale of halal medical beauty-related products or health foods, because the source of the medicine capsules is collagen from animal tissues, it needs to be extracted from animal skin, bones, white connective tissue, etc. Muslims will refer to whether they have obtained halal certification when taking medicines. To ensure that manufacturers use raw materials and capsule ingredients that comply with Islamic law and their production methods and products. In the future, there is a chance to become a Northeast Asian logistics center for halal products, providing raw materials or related products that have passed halal certification. In order to achieve the idea of a logistics center, a halal product platform should be actively established to provide countries or demand units with inquiries about relevant information.

4.5 The Muslim population in central Taiwan has about 200 registered households, and Taiwan's alcohol regulations for halal products must be less than 0.5%

The interviewee mentioned a conservative estimate of about 250,000 Muslims in Taiwan.

The number of registered households in the Taichung Mosque is mainly distributed in six counties and cities in the central region (Miaoli, Taichung, Changhua, Nantou, Yunlin, Chiayi), and the number of households is about 200. They established the Muslim University Student Association to provide a platform for exchanges between Muslim students who come to Taiwan to study. Because in Islamic law, alcohol (Khamr) itself is classified as filth (Najs), and everything contaminated by it is contaminated.

However, alcohol (ethanol) is not equal to wine. Agrochemical (non-wine industry) methods can be used to obtain alcohol from carbohydrates such as molasses and starch through the biological fermentation process. Beans, soybeans and other grains are brewed and fermented, and their ingredients may also contain trace amounts of ethanol. The most profound issue in the halal accreditation between the countries' Halal Authority is the variability in resolving the percentage of permissible ethanol for halal food production (Ahmad, Yang, Norziah, Wan, & Abdullah, 2014). The residual amount of alcohol in halal products requires different national standards. For example, Singapore, Thailand, Indonesia, and other countries need to be less than 1%; Singapore, Taiwan, and other countries need to be less than 0.5%.

5. Conclusion

The results of this study found that all countries have dedicated units for halal product certification. For example, Indonesia is in charge of national religious affairs by the Council of Religious Scholars; Malaysia is in charge of the Ministry of Islamic Affairs Development;

in Taiwan, the "Taiwan Halal Industry Quality Assurance Promotion Association" is in charge of halal products. Certification: The "China Islamic Association" is responsible for the certification of restaurants, restaurants, and slaughterhouses. As the Taiwan Halal Industry Quality Assurance Promotion Association plans to establish a halal product export chamber and a halal product e-commerce platform in 2021, and Taiwan has an international standard in medical technology and food extraction technology, it has the opportunity to become a Northeast Asian logistics center for halal products. The results show that Taiwan has the development elements to promote halal certification products in the future, but currently lacks professional talents related to halal industry chain certification. Learn the curriculum methods, promote the halal industry and certification methods, and actively cultivate halal-certified professionals.

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The Case Study of the Three Halal Certified Companies in Taiwan

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Abstract

Taiwan is one of the most influential countries to visit and travel in Asia. For the past years, Taiwan has risen its interest to enter the emerging Muslim markets. Many businesses apply for Halal Certification, in order to promote their products to the Muslim nations for New Southbound business expansion. The research aims to explore three companies through interviews after they successfully applied Halal Certification. The result has shown the products are mainly targeted to Muslim consumers who reside in or travel to Taiwan, and as for the exporting food products will be altered to fit the taste of local Muslim; for marketing, the businesses mainly use internet marketing to do promotion and increase publicity.

Keywords: *Halal Certification, Muslim*

1. Introduction

Taiwan is an export-oriented vigorous industrial economy. Over the last several decades, it has always been able to produce and supply all kinds of relatively inexpensive products with excellent and stable quality, often catered for different markets. In recent years, industries of various fields such as agriculture, seafood, processed food, food flavoring, healthy food, biotech, pharmaceutics, cosmetics, and even food machinery, have approached Mosques in Taipei, Taichung, and other cities for Halal certification（Taiwan Halal Integrity Development Association, nd）.

A Halal certified product is a product certified to comply with a series of manufacturing standards specified according to the Islamic Law or 'Shariah'. These standards regulate all the related aspects of the products, including its ingredients, feeds, and slaughtering of animal-based material, manufacturing process, hygiene and safety requirements, packaging, labeling, and transportation, etc. Meticulous care must be taken during the certification process to exclude any ingredient that is not compliant with Islamic Law or has been contaminated by any incompliant material. Not only Halal food is Islamically legal for Muslims to consume, but also appeals to the current consumer market trend, healthy, hygienic, and safe. Therefore, Halal products have emerged as a very important new business opportunity（Taiwan Halal Integrity Development Association, nd）. Many companies in Taiwan have already applied for halal-certified products. Therefore, the purpose of this study is to understand the current status of halal-certified companies selling halal-certified products, to serve as a reference for companies that have not applied for halal certification.

2. Literature Review

Since halal has become a huge globalized market (Atalan-Helicke, 2015), there has been recently an exponential growth in halal products and brands in areas as diverse as finance, banking, pharmaceuticals, textile, cosmetics, fashion, schools, media outlets, and tourism (Yener, 2015). By 2030, the global halal market size is estimated to reach US$ 10 trillion (Ali, Tan & Ismail, 2017). The demand for safe and halal food continues to increase (Kohilavani, Abdullah, Yang, Sifat & Zzaman, 2021). Muslims want assurance for their consumable products to follow Islamic principles and be wholesome (Abdul, Ismail, Hashim, & Johari, 2009; Van der Spiegel et al., 2012). Food manufactures have to go through multiple systems and certifications of food safety and halal to full fill the market demand (Kohilavani, Abdullah, Yang, Sifat & Zzaman, 2021).

Several halal standardization and certification organizations have been established worldwide (Neio Demirci, Soon, & Wallace, 2016; van der Spiegel et al., 2012; Ziegler, 2007). Two units in Taiwan assist halal certification products. The Taiwan Halal Integrity

Development Association (THIDA) is responsible for halal-certified products such as processed foods and fresh fruits and vegetables. As the global Muslim market is developing robustly, THIDA will serve as a platform for more collaboration between government offices, industry players, and academic institutions, promote legislation of government acts to facilitate the manufacturing and exporting of Halal products, help businesses dealing with Halal products be integrated horizontally and vertically, and invite academic arena in leading and guiding towards latest technologies, encourage establishing Islamic financial services and Muslim tourism, and participate in developing business opportunities in the Muslim market (Taiwan Halal Integrity Development Association, nd). The Chinese Muslim Association is mainly responsible for the certification of domestic catering, slaughter, meat supply, and other services for domestic parents and relatives. On behalf of all Muslims in Taiwan, he handles international affairs, promotes national diplomacy, promotes religious affairs, educates, trains young talents, promotes doctrines, and maintains the religious life of the faithful.

Among them, Taiwan Halal Integrity Development Association has joined Jabatan Kamajuan Islam Malaysia-JAKIM, Department of Islamic Development Malaysia, Majelis Ulama Indonesia-MUI, Indonesian Council of Ulama, Majlis Ugama Islam Singapura-MUIS, Islamic Religious Council of Singapore, International Islamic Halal Organization -IIHO, KSA, International Halal Integrity Alliance-IHI, World Halal Food Council-WHFC, Association of Halal Certifiers-AHAC and other units to assist domestic manufacturers in completing halal certification procedures and export products.

Huge demand by Muslim consumers to the need for halal verification led to the issuance of halal certification by the halal authority. Amid the growing interest in halal consumption, halal does not only apply to foods/poultry but also covers other products for consumption, such as pharmaceuticals, medicine, and cosmetics (Panzi, Man, Nawawi & Abu-Hussin, 2019). According to the List of Establishments with Current HALAL Certificates Issued by THIDA, as of December 2020, Taiwan has applied for a total of 534 halal-certified products from the Taiwan Halal Industry Quality Assurance Promotion Association. The categories they applied for were mainly food and ingredients, accounting for 25%; followed by health food for 20%, beverages and beverages for 16%, snack food for 10%, and other categories totaling 29%. Among them, the proportion of approved poultry/meat categories is 0.1%, and the only approved manufacturer is Yunlin Yuanchang Poultry Product Coop. It can be seen that the rate of my country's export of poultry or meat is relatively low, and there is still room for continuous improvement.

3. Research Method

This study is based on the list of companies applying for halal certification products from

the "Taiwan Halal Industry Quality Assurance Promotion Association", and selected companies whose certified products are similar to the subject of this research as the main interview subjects, including Yunlin Yuanchang Poultry Product Coop., Sinyi Township Farmers' Association, Hung Gee Bees Honey Farm Co, etc. The three case companies are very representative of the agricultural enterprise companies in Taiwan. They learned about the sales status of the case companies' halal-certified products through interviews.

4. Results and discussions

4.1 Taiwanese companies obtain halal certification. Products are mainly purchased by Muslims who come to Taiwan to live or travel; sales channels in Taiwan are mainly retail stores, and overseas are mainly Chinese supermarkets or restaurants

The company's halal certification is of little help to its operations. Currently, it mainly provides purchases for Muslims who come to Taiwan to live or travel, and there is no difference in the sales volume for Chinese people. In addition, if you want to import Taiwan's halal-certified products to other countries, the halal certification mark needs to be recognized by that country, not a single halal certification mark issued by Taiwan. For example, if you want to import halal-certified products from Taiwan to Indonesia, the products must be affixed with a seal issued by the local halal certification unit in Indonesia before they can be sold. In terms of sales channels, Taiwan's main sales channels are mainly company stores or channels that have negotiated cooperation; foreign sales channels are Chinese supermarkets or restaurants. Due to the taste of meals and brand reputation, they mainly provide Chinese purchases. , Followed by the ingredients used in the restaurant.

4.2 Taiwan's halal certification needs to apply to the "Taiwan Halal Industry Quality Assurance Promotion Association"

The interviewed companies mentioned that applying for halal certification products accounted for a relatively low proportion of the company's products, mainly because halal certification products can bring less revenue to the company, so it failed to induce application motivation. Regarding how to apply for certification, an application form must be filled in for a Muslim country to certify a halal product. Taiwan uses a turnkey approach to apply to the "Taiwan Halal Industry Quality Assurance Promotion Association" based on the company's needs, fill out an application form with multiple items, and the association arranges audit team members and teaching and legal personnel to conduct the field in the relevant field. After investigating and understanding the production process of applying for certification products, and ensuring that each process complies with Muslim doctrines, halal certification marks will

be issued for the applied products. It takes 3 months from application to certification.

4.3 Companies promote halal-certified products through online marketing

The interviewed company mentioned that it will participate in the Taipei Food Show in 2020 to promote halal-certified products because the exhibition is divided into two venues, Nan gang Exhibition Hall and Taipei World Trade Center. Halal-certified product booths are allocated in Taipei World Trade Center. Since the food show is divided into two venues, the product attributes of each venue are insufficient to promote information. Foreigners may not see the introduction of halal-certified products due to different venues, resulting in the number of visitors as expected, the company was unable to actively promote Taiwan's halal-certified products to foreign customers. In addition, because the company in the case promotes Taiwan's halal-certified products on the official website or the webpages of local marketing channels, a small number of foreigners will come to the site to learn about the halal-certified products sold by the company, in order to understand the exterior, content, and taste of the products. Assess the possibility of introduction to local sales in the country. It can be seen from this that when handling food exhibitions or related exhibitions, organizers and companies should increase the description and guide of the exhibition location, and use online marketing to increase the possibility of companies selling halal-certified products at home and abroad. Furthermore, if the company wants to promote halal-certified products abroad, it needs to send company personnel to the country to receive education and training in related courses, and Muslims have different tastes of ingredients from Taiwan. If you want to sell them abroad, you may need to adjust the taste of the ingredients. The main difficulty is that Muslim countries are cautious. For halal-certified products, the main products are the seals issued by the certification body of the country, not the seals issued by the Taiwan halal certification unit. As a result, the company's export sales to other countries have increased the proportion of sales. Lower.

4.4 In this case, the company sold halal-certified products. The foreign business model is to establish a subsidiary; in Taiwan, it mainly focuses on existing stores and channels.

The main business model of companies selling halal products abroad is to establish subsidiaries. If local companies or people are interested in Taiwan's halal products, they can jointly fund the establishment of a subsidiary, and hire local employees to increase the employment rate and help local product sales. , Develop the market with company partners and local employees. Furthermore, the company's products will be reviewed in accordance with the country's halal certification product specifications, and if necessary, the country's

halal certification mark will be applied in order to smoothly import Taiwan's halal products. Companies selling halal-certified products in Taiwan are mainly sold in existing stores and channels, and the original operating channels have not been specifically changed due to the sale of halal-certified products.

4.5 The competent authority invites companies interested in halal certification to apply for the international certification mark

The interviewed companies mentioned that applying for the halal certification mark is not as beneficial to the overall operation and sales as expected, but in the future, after the halal certification mark expires, they will continue to apply for the certification mark if there is demand. In addition, since it is expensive to invite foreign certification agencies to Taiwan to apply for halal certification, it is necessary to pay the air tickets and related expenses of the certified members in Taiwan. The interviewed companies suggested that the Council of Agriculture and other competent authorities invite representatives from Muslim countries such as Indonesia, Malaysia and other countries in Taiwan, and companies interested in halal certification in my country to jointly discuss halal certification marks and product sales issues.

For foreign certification agencies coming to Taiwan for certification, the competent authority may also be responsible for inviting foreign certification agencies to assist companies interested in applying for halal certification. The companies will jointly pay for their certification, reducing the burden of a single company’s payment, in order to successfully obtain the country. Halal certified product mark. In addition, the Indonesian halal certification body mentioned that in order to ensure good manufacturing practices for manufacturers, manufacturers should have a GMP (Good Manufacturing Practices) mark before they can apply for certification. However, Taiwan has canceled the certification of this mark and cannot comply with Indonesian certification regulations. Therefore, it is hoped that the competent authority can assist companies in solving basic certification conditions and trade issues, to improve the effectiveness of companies exporting halal-certified products.

5. Conclusion

This study aims to understand the overall operating conditions of companies in Taiwan that have applied for the halal product certification mark of the "Taiwan Halal Industry Quality Assurance Promotion Association". The results found that the company’s halal certification mark has not significantly increased domestic and foreign product sales. Since Taiwan is in the early stage of the promotion of halal products, its main sales targets are Muslims who come to Taiwan to study and travel. Enterprises should strengthen the promotion methods and strengths of sales channels to let Muslims living in Taiwan know

clearly about the sale of halal-certified products. Store. In addition, the company will set up a subsidiary in conjunction with local people in Muslim countries who are interested in introducing Taiwan's halal certification products to review the country's halal certification regulations, food preferences, tastes, etc., and make product adjustments to improve imported Taiwan halal certification product.

If a Muslim country wants to import Taiwan's halal-certified products, the product must have a halal certification mark that meets the requirements of the Muslim country. It is not a single halal certification mark issued by Taiwan, and the cost of inviting foreign certification agencies to Taiwan for halal certification is very high. High, resulting in a huge economic burden for enterprises. Furthermore, the Indonesian halal certification body mentioned that in order to ensure good manufacturing practices for manufacturers, manufacturers should have GMP (Good Manufacturing Practices) marks before they can apply. However, Taiwan has canceled the GMP mark certification and therefore cannot comply with Indonesian certification specifications. , That is, unable to obtain the halal certification of the Indonesian country.

Therefore, it is recommended that the Taiwan Council of Agriculture and other competent authorities invite overseas representatives from Muslim countries such as Indonesia and Malaysia, and Taiwanese companies interested in halal certification to jointly discuss and explore issues related to halal certification. Furthermore, if you intend to invite foreign certification agencies to Taiwan, the competent authority may be responsible for inviting foreign certification agencies and assist interested companies in discussing cost payment issues, reducing the burden on a single company, so that the company can successfully obtain the halal certification product mark.

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Trade Facilitation for Halal Food Import Clearance: Standard Procedures versus Halal Requirements

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Abstract

Trade facilitation is widely known as an aid to international trade for moving goods across border. World Trade Organization (WTO) initially introduced the concept of simplification, harmonization, standardization, and transparency related to border formalities whilst were translated into specific operational objectives namely speed, dependability, quality, cost, and flexibility to measure the operational goals. Substantially, this cross border formalities encompasses the procedures related to the cross-border handling of the Halal food supply chain in Malaysia particularly concentrating on the import trade activities. Thus, relevant agencies involve need to be identified concerning their roles and functions within the whole Halal process. The purpose of this paper is to explore the current state of the Halal import process for Halal food. This study used a series of semi structured interviews with 15 participants among border agencies from two import environment. It was found that regulation, policy, knowledge, experience, visibility, commitment, attitude, mentality, and consistency were identified as additional operational determinants to operational objective for Halal food import crossing. This study also demonstrates every facet of the border clearance activities in the context of Halal trade across the Malaysian border.

Keywords: *Trade facilitation, Halal food, Halal supply Chain, Cross border clearance*

1. Introduction

The fastest growing faith with 2.76 billion believers around the world is Islam which recognized as the second biggest religion after the Christian faith (Pew Research Centre, 2021). The Asia Pacific marks the highest number of Muslim distributions in the world with more than 986 million Muslims (Pew Research Centre, 2017) and within this figure Malaysia, a multiracial country with 66% of its people are Muslims. Naturally, the demand for Muslim Halal dietary grows equivalent to the indicated rising faith. Thus, Halal for Muslim is highly concerned issues not limited to its production but also bigger trading activities involving trade between countries.

Thus, it generates pertinent issues on the important effort of Halal food supply chain actors to protect the wholesomeness process of Halal food postproduction to fulfill the need of final Muslim's consumption at the destination country. Importation of food at destination absolutely involves destination country border procedures as compulsory formalities requirement prior release to the market. At the border environment trade facilitation portrayed as the utmost important aid during import clearance as a protection from formalities causing trade hurdles. The objective of this paper is to explore the current state of cross border process for Halal food import in Malaysia and recommendation will be made in terms of Halal facilitation operation.

2. Literature Review

2.1 Import Trade

Trading across border operation generally implicate with the breadth of logistics activities depending on the number of actors involved in the supply chain process including physical infrastructure services and the number of regulatory control imposed on certain import trade (Shrestha, R.and P. Kyophilavong (2021), Shepherd & Hamanaka, 2015). Within import cross-border trading activities, stakeholders respectively the importer and the exporter are two key main actors which initiated from business agreements between the two, whilst the logistics process determine the type of service providers as well as transportation of the goods, the cost involve and other related services. (Giuffrida, et al, 2019; Jensen, Niels Bjørn-andersen, & Vatrapu, 2014). In the early of 80's, improvement strategy for effective cross-border import environment is influenced by innovative action towards multitude factors including reduction of impediments from customs and trade policies within distribution channel (Anderson, 1985). Changes in trade and supply chain are driven by border public administration which associates with various operational concerns related to logistics and transportation to offset sophisticated problem along the cross-border and international

distributions (Hameri & Hintsa, 2009). Hence, trade facilitation initiative also links with cross-border activities that simply affected by various factors including regional border integration and cross-border import infrastructure (Fujimura, 2004). parallel important with a standard principle according to Islamic teaching. Halal logistics is an important requirement for Halal food trade in order to safeguard process characteristic into a set of principles, standards and specification in logistics operation (Omar, Jaafar, & Osman, 2010). Even though Halal products appear similar to other types of food, the way they are prepared, handled and processed from the origin right up to the retailer's shop has been done in accordance to Islamic requirements (Kalantari Shahijan, Rezaei, Preece, & Ismail, 2014). Halal logistics emphasizes on two important factors that influence the vulnerability of supply chain namely product characteristics and market requirements during operations (Tieman, Vorst, & Ghazali, 2012).

2.2 Strategic Operation Theory

Key indication for cross-border trade and transport facilitation attributes is related to strategic performance objectives which generally support the intervention of logic by providing a referential basis for operational improvement aligned with key strategic aspects of border-crossing activities and infrastructure. The structured perspective of the framework facilitates understanding and allows deconstruction of complex issues concerning the facilitation of trade and transport across borders into specific operation performance elements such as speed, dependability, flexibility, quality, and cost. (Batista, 2012). Slack et al, (2007) elaborate that the structured perspective of the framework facilitates understanding and allows deconstruction of complex issues concerning the facilitation of trade and transport across borders into specific operation performance elements such as speed, dependability, flexibility, quality and cost (Batista, 2009). Strategic operation paradigm is used widely in logistics and supply chain research especially for such decision-making support and performance strategy (Vivares-Vergara, Sarache-Castro, & Naranjo-Valencia, 2016; Kim, 2013; Trapczynski & Wrona, 2013; Wong, Skipworth, Godsell, & Achimugu, 2012; Skinner, Bryant, & Richey, 2008; Defee & Stank, 2005)

3. Research Methodology

This article adopts a case study with a qualitative approach. The data collection is based on face-to-face in-depth interview with sea freight international cross-border import communities as selected case studies. Participants were selected from all stakeholders involve in food import clearance. The following stakeholders have been interviewed: Royal Malaysian Customs; Malaysia Quarantine and Inspection Services (MAQIS); Health

Department-Food Quality and Safety Division, free zone warehouse operator, terminal operator and forwarding agent. The number of participants is detailed out in Table 1 as per the following:

Table 1 List of Participants

No	Type of Organisation	Participants Code	Designation	Length of Services
1.	Agency A	P19A	Senior Manager	22 years
2.	Agency A	P19B	Head of Import (West)	22 years
3.	Agency A	P19C	Head of Import (South)	18 years
4.	Agency A	P19D	Head of Import (North)	19 years
5.	Agency A	P19E	Assessment Officer	4 years
6.	Agency B	P17A	Senior Officer	25 years
7.	Agency B	P17B	Senior Officer	23 years
8.	Agency B	P17C	Officer	23 years
9.	Agency B	P17D	Officer	23 years
10.	Agency C	P18A	Officer	6 years
12.	Agency C	P18B	Officer	6.5 years
13.	Agency C	P18C	Officer	6.5 years
14.	Company J	P3A	Manager	18 years
15.	Company T	P4A	Senior Manager	20 years
16.	Company T	P4B	Senior Manager	21 years
17.	Company T	P4C	Senior Executive	16 years
18.	Port N	P1A	Operation Manager	15 years
19.	Warehouse D	P2A	Supervisor	18 years

A set of six open-ended control question was used based on the existing trade facilitation practice for food import clearance. Participants were approached 3 weeks in prior by using formal letter, electronic mail (e-mail) and follow up by calls to confirm interviews.

The interview starts with an initial question, of introductory nature, aiming to assess the overall perception of the interviewee on the evolution of import clearance. After that, the conceptual model, and its dimensions (procedures, structure, actions, and activities) were presented to each interviewee followed by four key questions to identify how process has evolved in import. The interviews were rounded up with a final question in which what could change in the operational strategy, actions and elements were assessed, to generate better outcomes.

4. Findings and Discussion

The main results of the study are strongly connected to the strategic and operational cross-border for trade facilitation of Halal food import. Based on the conducted case study

there are three pertinent operational segments during import clearance activities discovered as the important highlight for this research. It is respectively involving physical handling, data and documentation and relevant strategic operational factors that identified as the influence of effective operation.

4.1 Physical Handling for Halal Food Import

During cross-border import, there are three important stages involving physical cargo handling, terminal handling, authority examinations and agent's storage. The three physical handling stages are crucial to food import especially for Halal food consignment before it is released to the local destination.

4.2 Terminal Handling

Terminal handling a crucial activity with regards to all type of cross-border import particularly for via seaport. For this seaport terminal handling commonly involves both human intervention and machine to move physical consignment from the carrier to the temporary storage located at the dedicated free zone area while waiting for shipment clearance. For land cross-border involving road transport and train services terminal play some minimum roles to the consignments because cargoes are remaining mounted on the truck while along clearance whereas shipment by train is unitized in a container before transferred to haulage for door delivery. Therefore, the level of importance associated with the terminal handling operation varies according to border environment and cargo unitization. During the transit of cargo through the terminal, Halal food consignment is facing with handling risk especially for less than container load shipment. Normally, consignments are handle using minimum information appear in the electronic manifest system which normally does not have a proper indication for Halal food consignment. Therefore, its increase the possibility of cross-contamination between Halal food and non-Halal food without a proper segregation and handling according to Halal logistics principles.

4.3 Authority Examinations

Another crucial stage for Halal food consignment is the authority examinations. Examinations by related authorities involving two activities including physical inspections and a sampling process for lab testing. For food consignment, the case study applies the same standard operating procedures for import which is determined by tariff code declared in the electronic declaration system. Generally, most of the food consignment is required for double inspections by two authorities involving health department for food safety control for human and another authority is known as Malaysia Quarantine and Inspection Service (MAQIS) whom responsible for food item control mainly to the safety of the local animal and domestic

plantations. Both authorities will conduct basic inspections procedures based on the assigned roles which involve physical handling activities. Based on officer's judgment authorized agencies will determine clearance approval or to conduct further for any finding on peculiar or suspicious condition of the physical cargo. Accordingly, Royal Malaysian Customs (RMC) also conduct examinations to confirm cargo value and import volume before cargo release to the importers or their forwarding agents. Detail examination is not referred to any Halal inspection guideline as a precaution of any potential cross-contamination from the inspection bay conditions, the tools and from any human factor.

4.3 Agent's Storage

Some import consignments are deal with storage in the free zone area. It is a part of a strategy to reduce the clearance cost, especially for dutiable cargo. Free zone storage service provides an importer facility to clear their import consignment through the partial clearance. Based on data from the case study, finding shows the potential threats for Halal practice of warehouse operation. Commonly, warehouse in the free zone operates under a conventional environment that barely practice according to the Halal standard where all the necessary requirements should be adhered especially involving Halal food consignment. Therefore, there are still lacking implementation and practice for Halal as guided by MS2400-2:2019 Halal Warehouse Management. Most of the food cargo are handle by non-certified free zone warehouse which generally involves the mixed storage and mixed transportation for final delivery. Equipment and tools for Halal and non-Halal are mixed with one another either in the dry warehouse or cold-room storage with improper segregation. This is practice expose food items to cross contamination.

4.4 Data and Documentation for Halal Import Clearance

Second operational activities based on findings is data and documentation related to Halal import clearance. The identity of every import consignment is determined by information declared in through the electronic platform and supporting documents presented to the related authorities as part of the assessment process. Thus, there are three factors influence the facilitation objectives for Halal food import

4.5 Electronic Data Declaration

Import declaration involves declaration from shipping agents through electronic manifest (e-manifest) to indicate a general description of a shipment. Electronic manifest is linked with Customs Information System (SMK), a special database system for cross-border activities hosts by Royal Malaysian Customs which also shared by other authorities. The information from e- manifest is used by port authority and regulators as a preliminary signal to standby

with their operational plan according to their separated procedures. For example, food in the manifest is declared as meat without detail descriptions. Due to the subjective description will automatically trigger both the health department and MAQIS as relevant food authorities for physical inspection. Consignment will be checked and remark by both agencies in a specific system for import declaration.

Meanwhile, importers' agents are accountable to declare import shipment in another system known as electronic declaration system (e-declare) which also linked to the SMK. State of every product description and shipping information are revealed in the declaration including the right tariff to represent product classification which determined the duty and taxes as well as regulatory process related to the specific consignment. Based on the tariff code selected system will auto response for related authority's approval the moment electronic declaration sent for assessment. The information then will be crossed assess with inspection findings and all required documents as per import requirements. Clearance progress is appearing in the import system screen which accesses to all authorities and registered public users.

Besides the three main reference system, there is also additional import risk assessment tool used by health department known as Food Safety Information System of Malaysia (FOSIM) for the purpose of food safety control subject to international food act and Malaysian food regulation all safety requirements but excluding Halal criteria.

4.5 Physical Documents Assessments

Presentation of related trade and shipping documents is compulsory requirements for cross-border import clearance. Specifically, for food import shipment, a copy of customs declaration is submitted with of trade documents (invoice, packing list, import permit, certificate of origin, etc.) and transport or ship evidence (delivery order/Bill of Lading air waybill). Two additional documents entwined with food import is health certificate and Halal certificate for Halal meat and poultry. Physical documents undergo detail assessment process by respective authorities' officers. According to the current import requirement Halal certificate is only required for meat and poultry import only but not for other food import. This does show that food majority of food import is not filtered accordingly from Halal control procedure.

4.6 Elements of Operational Objectives for Halal Food Import

In addition, to section A and B, findings from the four case studies also highlighted on the importance of below mentioned operational elements for trade facilitation of Halal food import. The eights elements are respectively as per the following:

- Regulation
- Policy
- Knowledge
- Experience
- Visibility
- Commitment
- Mentality
- Consistency

Each of the above elements plays important roles in every clearance stage that affect the trade facilitation performance especially for cross-border import clearance for Halal food into Malaysia. The elements are derived from analysis of detail cross border clearance process in four border environments.

5. Conclusion

Basically, the operational objectives for trade facilitation are not limited to the existing principle of five elements as indicators of operational performance during cross-border activity. In a wider operational scope of trade and transport facilitation, it is indeed relevant to the generic operation for the import process. Nevertheless, in the event of Halal food consignment, it is crucial to understand the cross-border operational objectives requirement based on the characteristics of the product and the principles of Halal logistics to determine the future reference of trade facilitation on the Halal logistics cross-border scope.

The identified process and the newly discovered performance objectives are very important to measure the effectiveness of Halal import control as well as to determine our performance in term of facilitation operation within the boundary of cross-border import

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Sustainability Implementation through Halal Supply Chain in the Agricultural Sector

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Abstract

The concept of supply chain management and sustainability have gained interest among the academics and practitioners in the 1980s. Even though the sustainability concept was emphasized on creating awareness on the ecological crisis at the end of the 20th century, industry began to realize that by adopting the supply chain management approach, organization may reduce cost of operation, waste and became more efficient in utilizing its resources and thus become sustainable. Concurrently. In the beginning of the year 2000, the growing number of Muslim populations has attracted businesses to embrace the concept and halal practice. The basis of halal practice is to avoid contamination from haram and hazardous sources to preserve the quality and safety of the food products. The consumption and promotion of the halal food is becoming significant as it relates with quality, cleanliness and safety. By reviewing and integrating the three concepts of supply chain management, sustainability and halal practice, this study proposes a framework of Sustainable Halal Supply Chain (SHSC) to be adopted and adapted in the agriculture sector. It demonstrates 4 crucial components that forms the foundations of a successful SHSC namely dedication and segregation, identification of Halal Control Points (HCP), sanitation practices and traceability.

Keywords: *Halal supply chain, Sustainability, Supply chain management, Agriculture, Traceability*

1. Introduction

Several studies have shown that many extensive new concepts could be developed by adopting a supply chain approach because supply chain encompasses products from sourcing and processing of raw materials to delivery of products to the final consumers (Jaafar et al, 2018; Seuring and Muller, 2008; Linton et al, 2007). The fact that it integrates all aspects of the supply chain, from the supply of raw materials to the supply and/or resumption of goods; may reduce the overall costs of the supply chain partners (Khandelwal et al, 2021).

Concurrently, the concept of sustainable development, which came in 1987 (Pisani, 2007) became one of the most important topics in the field of supply chain management in the early 1990s (Seuring and Muller, 2008). This concept has formed the basis of decision-making among companies (Sanchez-Flores et al, 2020). In the agricultural sector, sustainability improvement triggers the particular interest of the academics and practitioners as the Agriculture, Forestry and Land Use sector is the second-larger emitter of greenhouse gas (GHG) emissions in 2020, i.e., 18.4% (Our World in Data, 2020). Of this value, the food production is responsible for one-quarter of the world's greenhouse gas emissions (Our World in Data, 2019) because it represents the essential source of food, income, and employment, especially for the world's rural population (Nematollahi and Tajbaksh, 2020).

In the beginning of the year 2000, the growing number of Muslim populations has attracted businesses to embrace the concept and practice of halal. A study by the State of the Global Islamic Economy Report 2020/21 highlights that Muslims spent USD2.02 trillion across food, pharmaceutical, cosmetics, fashion, travel and media/creation sectors. This spending reflects a 3.2% year-on-year growth from 2018. It is forecasted that Muslims spending is reaching USD2.4 trillion by 2024 at a 5-year Cumulative Annual Growth Rate (CAGR) of 3.1%. The halal food sector accounts the highest investment indicating 51.86%. The basis of halal practice in producing halal products is to avoid contamination from haram and hazardous sources to preserve the quality and safety of the food products. The consumption and promotion of the halal food is becoming significant as it relates with quality, cleanliness and safety. Several authors emphasize that halal concept for a product should be viewed from a supply chain perspective (Omar and Jaafar, 2011; Omar et al, 2013; Jaafar et al, 2011). It is because the process of producing halal products does not only encompass the production processes, but also involves all activities throughout the supply chain including the source of supply, handling, storage, warehousing, manufacturing, and transportation activities. Throughout these supply chain activities, various circumstances could expose the halal products into risks of contamination with haram and hazardous sources that may affect the halal status of the product before it finally reaches the consumers. Previous research in the agriculture sector have largely been focused on food quality and food safety issues of the

crop-based products particularly in the manufacturing aspect. However, research that are concentrating on halal and sustainability of the supply chain of agriculture products have been largely neglected. The lack of Sustainable Agriculture Supply Chain (SASC) (Nematollahi and Tajbakhsh, 2020) that integrates the halal elements has called for more research to be conducted in these areas.

Having considered these gaps, this study proposes the concept and framework of Sustainable Halal Supply Chain (SHSC) to be adopted in the agriculture sector to ensure quality and safe consumption of agriculture products. The framework is developed based on strong foundations of sustainability supply chain and halal supply chain theories.

1.1 Sustainable Supply Chain in the Agricultural Sector

The concept of supply chain management has gained interest since the 1980s when companies recognize the benefits of collaborative relationships. They realize that companies may have issues to compete if they work in isolation of their suppliers and other entities along the supply chain (Lummus and Vokurka, 1999). In this concept, the optimization of operations has moved from a specific element of supply chain to the entire supply chain, leading to the greatest product value and the lowest possible cost (Moir and Carter, 2012). Since then, SCM concept has grown by placing the emphasis on logistics and transportation, operations management and materials/distribution management, marketing, as well as purchasing and information technology (IT) as its foundation (Soni and Kodali, 2013; Giunipero et al, 2008).

Concurrently, the concept of sustainable development that appeared in 1987 in the context of increasing awareness of looming ecological crisis, became one of the major influences at the end of the 20th century (Pisani, 2007). It was emphasized in the Brundtland Report (1987) that “sustainable development is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs (WCED, 1987, p.43). By adopting supply chain management approach, organization may reduce cost of operation, reducing waste, using more from less and efficiency-oriented planning. The growing concerns on the limitation of resources, global warming, and greenhouse gases (GHGs) as well as consumer health that have called firms to incorporate sustainability practices into their company strategies (Dey et al., 2011; Lee, 2010). Hassini et al (2012) define Sustainable Supply Chain Management (SSCM) as the management of supply chain operations, funds, information, and resources to maximize the supply chain profits while simultaneously maximizing social well-being and minimizing environmental impacts. The concept of social, environmental and economic responsibilities forms the basic foundations of sustainability that need to be implemented by organizations. Several authors

suggest that sustainability in the supply chain networks may assist organizations to achieve better performance (e.g., Dubey et al, 2016, Tsoulfas and Pappis, 2006; Yusuf et al., 2013; Plambeck et al., 2013). Being the significant contributor of the essential source of food, income, and employment; research on sustainability in the agricultural sector is considered vital (Nematollahi and Tajbaksh, 2020).

Van der Wiel et al. (2019) defines agriculture as the science and art of cultivating the soil, producing crops and raising livestock that are directly or indirectly benefiting to humans. It includes other functions such as financing, processing, marketing and distribution of agricultural products, farm production supply and service industries, health, nutrition and food consumption. The use and conservation of land and water resources, development and maintenance of recreational resources, and related economic, sociological, political, environmental and cultural characteristics of the food and fiber system, which extremely formed the basis of civilization are also in the scope of agriculture. All aspects of crop production that comprises all activities: i) processes, ii) reserves, such as soil as a nutrient reserve, and iii) nutrient flows associated with the production of arable crops, including fodder, fruits and vegetables, horticulture, and grasslands are also encompassed in its scope. Khandelwal et al, (2021) indicates that various studies in the agricultural supply chain (ASC) focuses on the agricultural goods such as milk products, grain, vegetables, meat/fish, flower, fruit, etc. Various enablers, barriers, and performance indicators have also been identified throughout these studies. For example, the barriers to the effectiveness of ASC have been identified as cold storage unavailability, lack of government regulations, inappropriate communication, lack of availability of processing and sorting technology, inadequate storage, handling unskilled workers and bad marketing network link (Rais and Sheoran, 2015). As a result, about 30-35% of all food grown is discarded due to the absence of efficient infrastructure and food supply chain (Parwez and Sazzad, 2014). In a review study by Nematollahi and Tajbakhsh (2020), it was highlighted that studies in SASC on economic and social components have always been neglected. The largest number of SASC were focusing on the environmental components of sustainability particularly the impact of carbon footprint and GHG emissions. The social components related studies, on the other hand, have put more attention of the food quality and safety issues. They also found that crop-based products were given more focus, while studies on the category of livestock and dairy items are lacking. Livestock supply chains plays an essential role, contributing up to 40% to the value of global agricultural production (Enahoro et al., 2019). Recent changes in dietary habits, along with growing populations, are rapidly increasing the demand for livestock-derived foods, which is becoming a significant challenge to achieve sustainability (Vasquez et al., 2019). Nematollahi and Tajbakhsh (2020) also suggested that more research should be conducted on cold-chain

SASC systems due to sensitivity of agricultural items to temperature.

From logistics perspectives, the International Forwarding Association (2016) highlight that food manufacturers face multiple risks associated with transportation, storage and delivery, which include storage at the point of origin, loading in refrigerated trucks, warehousing facilities, stuffing containers, shipping containers to the terminal for loading onto a feeder ship, until trucks deliver products to the consignee's warehouse. Major risks for manufacturers include deterioration due to shipping delays, contamination with fungi and bacteria, damages, spills, and breakages, and sub-optimum conditions during shipping. Fungi and bacteria thrive on food products and may cause contamination and food poisoning or foodborne disease. Contamination may occur at all stages, including packaging, processing, shipping, and storage and distribution. Chemical contamination is also a health hazard that can result in a range of symptoms and problems, including neurological, renal, and hepatic syndromes. To avoid contamination, the delivery must follow strict safety and hygiene procedures and ensure that staff is experienced and trained in food safety. Damages, breakages, and spills occur during shipping may result in significant losses for food manufacturers. Thus, special procedures must be in place during loading, shipping, and unloading to avoid damages. All these issues could be addressed by the implementation of halal supply chain.

1.2 The Concept of Halal Supply Chain

Beginning the early of the year 2000, the concept of halal has increasingly attracted the attention of businesses widely because of the rising number of Muslim populations globally. Halal is an Arabic word which means lawful or permissible. The term halal is used by the religion of Islam to guide Muslims in their daily life. Halal refers to all that is permitted, and Haram refers to all that is prohibited according to the Islamic guidelines. Generally, the specific reasons of Haram in Islam are to (1) preserve the purity of the religion (2) safeguard the Islamic mentality (3) preserve life (4) safeguard property (5) safeguard future generations (6) maintain self-respect and integrity (Ahmad, 2008).

The consumption and promotion of halal food is becoming significant as it associates with quality, cleanliness and safety as underlines by the Islamic principles that required Muslims to consume only halal products. Halal is obtained when all process of producing and delivery of the products to the final consumers comply with Islamic principles. The requirements to be halal are to ensure that the products are free from contamination with haram (forbidden by Islamic law) as well as hazardous products. As a result, the demand for halal food increases when the non-Muslims are becoming attracted to the safety and quality aspect of the halal products. On a religious standpoint, the demand is created based on the

religious belief that Muslim should consume only halal products. The failure to consume halal products would result to a sin commit by the Muslims. From a business perspective, halal practice has been considered as a business strategy that would bring market expansion (Nik Muhammad et al, 2009) as it addresses the growing number of Muslims and non-Muslims worldwide. The existing literature shows that the expansion of halal concept for a product has now expanded to include the movement of halal products along the supply chain (Omar and Jaafar, 2011; Omar et al, 2013; Jaafar et al, 2011). This is because the process of producing halal products does not only encompass the production processes, but also involves all activities throughout the supply chain including the source of supply, handling, storage, warehousing, manufacturing, and transportation activities. Throughout these supply chain activities, various circumstances could expose the halal products into risk of contamination with haram and hazardous products that would affect the halal status of the product when it reaches the final consumers. Thus, the handling of food along the logistics and supply chain process is deemed crucial (Al-Qardawi, 2001). It is because the halal food production will be meaningless if the halal and cleanliness of the food is not taken care throughout the delivery process from the source of supply to the final consumers. Therefore, the status of a halal product could be gained when all possible contamination caused by haram and hazardous products could be avoided throughout its supply chain process (Omar and Jaafar, 2011; Omar et al, 2013; Jaafar et al, 2011) until it reaches the final consumers. Therefore, a halal process could be viewed from a supply chain perspective because a halal product could only be obtained when the entire activities throughout the supply chain process is dedicated only for halal products or segregated from the haram and hazardous products (Jaafar et al., 2017).

1.3 Discussion and Propositions

As indicated earlier, halal practices are derived from the Islamic guidelines that determines the sources of contamination which can be from the haram and harmful sources that can lead to the halal product become haram (forbidden) or hazardous, thus unsafe for consumption (Al-Qardawi, 2001). The lack of temperature control as well as the sanitation practices may also lead to the contamination of the products. Apart from the haram sources, which need to be avoided, temperature control should always be maintained to avoid the food from being contaminated. Having considered the gaps in the literature and the issues demonstrated earlier, this study proposes a framework of Sustainable Halal Supply Chain (SHSC) to address the importance of safety of the agriculture products throughout its movement along the supply chain. Therefore, four important components were found to be crucial in ensuring the effectiveness of Halal Supply Chain practice.

1.3.1 Dedication and Segregation Practices

It is generally understood that consolidation of halal products with haram and hazardous during storage and delivery may lead to contamination. The contamination refers to the contamination with haram and contamination with hazardous products; or the halal product itself can be contaminated and becomes haram and hazardous due to lack of monitoring and control during the handling process. Similarly, contamination may occur when the products are stored and delivered at the storage facilities and vehicles that have been used to store and carry non-halal products. Thus, one of the successful practices is to ensure the principle of dedication and segregation be implemented. This is because the possibilities for halal products to contaminate is much more lesser when the storage, delivery and handling are dedicated for halal products. However, when the halal and non-halal products or hazardous and non-hazardous products are consolidated, then the principle of segregation should be applied. This is because the possibilities of the cargo to contaminate is higher when these products are consolidated.

1.3.2 Halal Control Point (HCP)

Following the above, the identification of halal control points is crucial in ensuring the successful implementation of halal supply chain. Halal control point is a point, step, or procedure at which control can be imposed and contamination can be prevented and eliminated (Department of Standards Malaysia, 2019a, 2019b, 2019c; Standard Metrology Institute for Islamic Countries, 2020a, 2020b, 2020c). The basic principle of dedication and segregation determines the degree of risks of the products will get contaminated. In handling the cold chain products, the control of temperature needs to be implemented as to avoid contaminations in both situations. To successfully implement the SHSC, the farmer together with the logistics service provider (LSP), for example, needs to identify the degree of risk in the halal control points that may cause contamination such as declaration of the past use of storage and vehicles for non-halal and hazardous products as well as loading and unloading of the halal products and other activities depending on the process flow of the products. Determination of HCP is vital as to ensure that the process flow would eliminate the risks of the halal cargo to be contaminated. To preserve the HCP, control measures need to be determined so that prevention may be conducted to reduce the risk of contamination. In any case of contamination occur, corrective actions that have been recognized earlier should be taken. The failure to comply with the standard operating procedure may lead to non-conformity of the process activities.

1.3.3 Sanitation Practices in Halal Logistics Operation

The World Health Organisation defines the term ‘sanitation’ as the provision of facilities and services for the safe disposal of human urine and feces. The word 'sanitation' also refers to the maintenance of hygienic conditions, through services such as garbage collection and wastewater disposal. Marriott, Shilling and Gravani (2018) define sanitation as “the creation and maintenance of hygienic and healthful conditions”. Sanitation in halal logistics requirements covers the general requirements for premises, infrastructure, facilities, and personnel along the supply chain.

1.3.4 Traceability

The establishment of an effective traceability systems was found as crucial to ensure the quality and safety of the halal cargo so that product recall may be performed in any event of contamination. This traceability system is an effective tool to improve the supply chain transparency (e.g. Zhang et al, 2013; Comba et al, 2013 and Dabbene, Gay and Tortia, 2014). Several authors highlight that food traceability is lacking because the traceability information related to food products and production processes is often lost within and between companies along the supply chain (Frederiksen and Bremner, 2001; Bertolini, Bevilacqua and Massini, 2006; Donnelly, Karlsen and Olsen, 2012; Donnelly, Karlsen and Dreyer, 2012). They urge for more detailed studies to be conducted at every stage of the supply chain process so that these processes could be documented, and the issues could be addressed (Framling et al, 2006, Bechini et al, 2008, Li et al, 2010, Karlsen and Olsen, 2011).

Monitoring the process flow of halal food and its parameters in the entire supply chain is therefore vital to ensure the status of halal, quality and safety is maintained. Hu et al (2013) highlight that to achieve a fully traceable supply chain, it is important to develop systems that facilitate internal and external supply chain traceability.

1.4 Development of Sustainable Halal Supply Chain (SHSC) Model

This study integrates all three components of the triple bottom line of environmental, economic, and social to produce a sustainability value to the ASC. From an economic perspective, the concept of halal supply chain provides value-added services offered to the customers in addition to the current services offered. Thus, customers who would like to request on halal products handling services, transportation and storage may do so, leading to demand fulfilment and satisfaction with the services. The environmental objective is achieved from the reduction of contamination, thus leading to the reduction of waste/defect products. Accordingly, the social element in this model is reflected in the responsibility of the entities along the supply chain in ensuring that the handling of halal product is free from

contamination with haram and hazardous, thus attracting the customers' trust in the service providers. The halal certification holds the branding that guarantee the quality of logistics services as it reflects its compliance to the halal supply chain standard guideline. The assimilation of all these sustainability elements qualifies the model to be called SHSC Model.

1.5 Research implications, Limitations of the Study and Directions for Further Research

This study contributes to the body of knowledge through the development of SHSC Model that can be adopted and adapted to the agricultural sector. The model specifies the presence of sustainable components (environmental, economic, and social) indicating that halal practice involves activities towards achieving a sustainable practice. Recent research suggests that sustainability plays an integral role in business activities because it enhances innovative outcomes associated with superior organizational performance (Schaltegger, LüdekeFreund and Hansen, 2016). The fact that the ASC are considered as business networks, which may lead to the entire chain competitiveness, (Bichou and Gray, 2004; De Langen, 2004; Notteboom & Winkelmans, 2002; Robinson, 1999), also reflect the crucial requirements of a joint effort among the entities in the entire ASC in addressing the sustainability and competitive challenge.

In ensuring a successful of SHSC implementation, this study found four (4) main variables that are considered crucial namely dedication and segregation practices, sanitation practices identification of halal control points and traceability of the halal products. However, more data are needed to refine and customize the model as according to the types of agriculture products because the configuration of the model will depend on the nature and process flow of each type of agriculture products. Thus, other variables and the detail process flow of the agriculture products need to be explored and identified. The variables might also different depending on the types of logistics operations that associate with varying degree of contamination risk.

From an industry perspective, the significant growth of global halal market has attracted many entities along the supply chain began to embrace halal supply chain spirit and practice to stay competitive. Having the major Muslims market in Malaysia and the world largest Muslim population neighbor market, Indonesia, reveals a huge potential market opportunity to serve. The remarkable development of the halal supply chain standards offered by Standards Malaysia provides a strong support for the halal supply chain implementation. The adoption of these standards at the Standards Metrology Institute for Islamic Countries (SMIIC), Turki has opened more opportunities for the halal supply chain certification at international level.

This model is significant as Muslims are very sensitive to the halal-related issues especially those products that they consume such as food and pharmaceutical. This is because the consumption of halal products is an order from Allah swt and those who do not obey will be considered as committing a sin. Fulfilling the responsibility to preserve the quality and safety of products is also partly depends on the integrity of each party along the supply chain, which would also provide avenues for further research.

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Social Prescribing and Leisure Agriculture in Rural Community

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Abstract

In general, the ordinary "social prescriptions" (SP) link cases and refer them to non-medical communities for non-clinical services. Responding to a great challenge of the super-aged society worldwide, "Taiwanese" SP embraces both healing and taking care of the cases in current situation. This article takes a case study on a rural community which is implementing tea-and-ceramic SP as an example. By heuristic evaluation to collect data cross 17 experts over 20 complementary therapies. Further research findings say that the core curriculum of tea-and-ceramic SP is almost equivalent to the category of "leisure agriculture". Mainly include: leisure and recreation therapy, landscaping horticulture therapy, clay work therapy and food therapeutic healing. The consistency reliability of content analysis are: 96.27 %, 91.32 %, 98.29 % and 90.12 %, etc., all above the accepted 85% inter-rater agreement also.

Keywords: *social prescriptions, leisure agriculture, rural community, therapy, healing*

1. Introduction

With a global development of social prescribing (SP) practice, mature executive technology and its business models feedback from local system worldwide. Now SP has gradually moved from the initial theoretical framework to an Implementation Science (IS), then more and more specific features out of the Asset Based Community Development (ABCD) as a methodology for the sustainable development of communities based on their strengths and potentials (Polley et al., 2017).

1.1 Social Prescribing as Implementation Science

The SP connected General Practitioners (GPs) and expanding treatment options to non-medical communities for non-clinical services with referral options. In previous years, 78% of GPs had prescribed an antidepressant despite believing that an alternative treatment might have been more appropriate. It also found that of the whole sample, 66% had done so because a suitable alternative was not available, 62% because there was a waiting list for the suitable alternative, and 33% because the patient requested antidepressants. Of the GPs surveyed, 60% said they would prescribe antidepressants less frequently if other options were available to them (Lynne, 2008). Advancing SP moderate unnecessary overlap of resources for medical waste, among GPs, facilitators (e.g., linkworker), and service providers by multi-adjustments to build a smart SP in the future (see figure 1.). An advanced smart SP model in UK, integrating patient online services into the records of GPs, automating the provision of SP and allowing patients to be self-care on a human-centered approach that help publics playing an active role rigorously in health-promotion and well-being (Liu, 2019). Associate to social determinants of health (SDH) and health outcomes has fueled a wave of experimentation around identifying and addressing patients' SDH in the context of clinical care. A core set of SDH measures in electronic health records (EHRs) for identifying patients' SDH needs use validated measures as available. Now, the social needs screening tools are used to inform clinical interventions, including providing socio-economic resources on-site (e.g., food boxes) and off-site community-based resources (e.g., food banks) collectively SDH-focused interventions undertaken in medical settings have been referred to be “SP” as an Implementation Science (IS; Gottlieb et al., 2018).

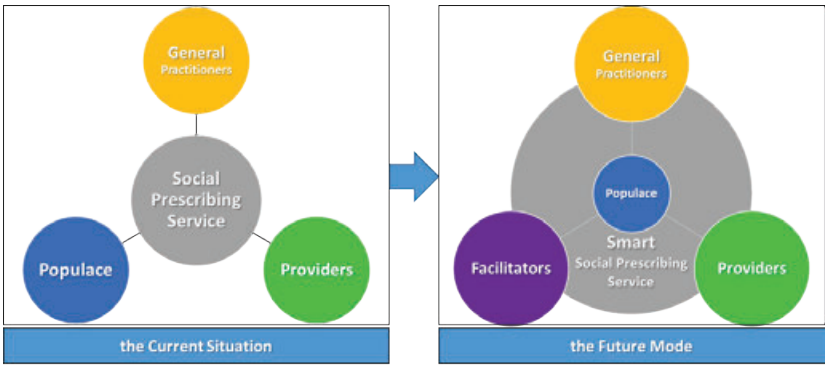

Figure 1 A smart shift of SP service in future

1.2 Rural Community-based SP of Covid-19 Pandemic in Taiwan

In the UK, SP is not limited to physicians but also nurses and caregivers included. In 2019, SP concept was launched in the Taipei United Hospital with atypical art prescription of integrated treatment including "visiting the museum" in the doctor's order and issued. Taiwan's long-term care 2.0 (TLTC 2.0) policy construct a Holistic Health Care service system, in which professional caregivers or case managers can make projects on the needs of each ones for relevant "long-term care SP." For example, the "holiday service" of TLTC 2.0 payment system, "accompanied outing" by shopping, social activities, affairs, religious activities, meals, walks, school, regular rehabilitation/dialysis, exercise, etc. It is also a long-term care prescription for the patients to maintain their social interaction (Kan, 2020). While Taiwan SP conjunct at Covid-19 pandemic eve, SP towards epidemic prevention mostly discourse in the suburbs or rural areas as another feature of Taiwan beside TLTC 2.0. The tangible and regional communities advocated to be a positive force that redraws closer social distancing and become an authentic base for SP practice (Hong, 2020).

2. SP Scheme and Long-Term Conditions

In practical, SP operate with social and emotional needs to non-clinical resources of community through comprise scheme. SP schemes, including arts, books, education and exercise “on prescription” refer who in need to community sources of non-clinical intervention. Then outcomes included increase in self-esteem and confidence; improvement in mental well-being and positive mood; and reduction in anxiety, depression and negative mood. (Chatterjee et al., 2018). Typically, SP schemes use community development workers with local knowledge linked to primary health care settings, therefore SP has potential to assist individuals presenting with social needs to access health resources and social support (South et al., 2008). For the cases’ sake, SP is long-term condition usually as that could not be cured at present but controlled by medication or therapies for a period of time.

2.1 SP Nonclinical Healing or Therapeutic Service

Over 20% GPs consultations involve with psychosocial needs because SP are short-term intermediary services that facilitate those emotional, social or psychological needs in non-clinical support. Detrimentally, affect patients' health for social isolation or low self-esteem could feel unable to manage time constraints, a limited knowledge of available support and traditional psychological services referral may be not appropriate (Kilgarriff-Foster and O'Cathain, 2015). For instance, there are 10 nonclinical healing/ therapies on prescription about: computerised therapy; books on prescription/bibliotherapy; exercise on prescription; arts and creativity; green activity/ecotherapy; learning/education on prescription; volunteering; employment (Lynne, 2008; Liu, 2019); information therapy; and food prescription (Liu, 2019) etc. Follow up these 10 SP intervention services in the western world, complementary and alternative therapy (CAM) refers to combine conventional medical care rather than replacing conventional medical care. CAM refers to a group of treatment methods that are not part of Western orthodox medicine, which includes a variety of traditional medical health care systems to benefit the elderly that its "heterogeneity" supplements and limitation breakthrough to mainstream medical care achieve an overall harmony of the body, mind, and soul health. In recent years, many therapies are suitable for the elderly widely used in nursing institutions as music therapy, clay work therapy, narrative therapy, sandplay therapy, painting therapy, dance therapy, drama therapy, photography therapy, aroma therapy, spiritual massage, diet therapy, Horticulture therapy, animal therapy, pastoral therapy, hypnotherapy, laugh yoga therapy, and body work, etc. Modern medicine has developed to molecular and genetic level, but aged population and increasing trend of chronic diseases are inevitable. Many diseases cannot be cured by drugs alone, multiple treatment options and long-term condition must be provided (Liang, 2009). This article illustrated 20 non-clinical therapies above to explore their differences to tea SP and ceramic SP on prescription with in-depth interview to the expertise in the tea and ceramic fields.

2.2 Linkworker Role-plays and SP Effect

Linkworker SP schemes include a number of interventions to conclude that paucity of evidence for individual interventions worthwhile uses of healthcare resources and explain their persistence and growth in the UK (Polley and Pilkington, 2017). To assess effects of SP service development on healthcare use and the subsequent economic and environmental costs. SP for mental healthcare create links with support in the community for people using primary care to reduce its carbon footprint by 80% by 2050 according to the Climate Change Act. No statistical difference in the financial and carbon costs of healthcare use between groups, SP showed a trend towards reduced healthcare use mainly due to a reduction in secondary-care

referrals compared with controls (Maughan et al., 2016). That is a great contribution to SP particular in local communities of rural areas, beside green footprints there are still many other assessment index for SP effect. SP is an emerging field and evidence base for the effectiveness of different approaches and interventions varies, the long-term aim of SP is to improve mental health and quality of life to ameliorate symptoms. SP outcomes assessment include a combination of indicators designed to capture changes in: individual mental health; population mental health, e.g. within a local authority ward, prison or workplace; individual behavior, e.g. physical activity, sensible drinking; quality of life; use of services, e.g. adult education, gyms, counselling; and professional practice, e.g. prescribing patterns etc. (Lynne, 2008). Across UK GP is under crisis for different models of SP have evolved to meet growth in patients' attendance. Adopts social return on investment (SROI) to analyze one holistic SP intervention find that investment of £2.90 for every £1 invested. A broader perspective on value is vital to encourage commissioners to invest in SP by understanding and monetizing social impact to the full value of SP (Kimberlee, 2016). Based on analysis of local practice delineates SP interventions into four types: Signposting, Light, Medium and Holistic, outlines that SP holistic interventions can contribute to improvement in patient wellbeing, reduction in anxiety and depression and attendance at GP surgeries (Kimberlee, 2015).

3. Research Design and Data Collection

This study take Xiangcun (香村) community in Hsinchu as a research subject to explore SP practice on tea-and-ceramic prescription following a serial projects on the Craft Community Development (CCD) since 2019.

3.1 Study Setting and Subjects

In less than 5 minutes footpath of Yuanpei (元培) Street, it connects with 7 running-well active facilities including C+ long-term care center, Practice Clinic, Practice Pharmacy, Tea Creation Center, Pottery Classroom, Art Center and Elderly Learning Center in a well-designed venue in-between YUMT and Xiangcun community. So prepared conditions help us to solve the clinical blind spots of the Taiwan SP prototype. Based on the above-mentioned 20 therapies, this study designed an in-field interview to tea, ceramic and healthcare professional about 20 experts. Each one interviewee takes 4 steps of process with introduction, explanation, discussion, and thematic cohesion. Through data collection and Content Analysis (CA) from the 20 participants' records. After cut out 3 more controversial respondents, it keeps 17 valid samples for heuristic evaluation. Among the 17 collected samples, there are 11 persons with tea art experience, 7 persons with pottery art experience, 3 persons with healthcare or caregiver background (one of whom also has painting experience),

and 4 experienced persons both as well as tea-and-ceramic art.

3.2 In-depth Interview and Content Analysis

The difference among three types of manifest, pattern, and projective content is not a clean trichotomy, their critical distinction is the locus of meaning. Such CA approach give a better position to select the most appropriate strategies for demonstrating validity and reliability on what kind of content they want to analyze and the role of theory in their studies (Potter and Levine-Donnerstein, 1999). Manifest coding employ the first definition of "content" believes that so-called content is settled between chapters in the context of storylines. With such kind of CA method, researchers will seek dominant encoding under a high degree of reliability (Su, 2012). The relationships of CAM and tea-and-ceramic SP on prescription is manifest content, it will be divided into three level to describe the correlation. To measure reliability of generating data, which leads to three manifestations of reliability: stability, reproducibility, and accuracy. All turn out to be functions of the agreement achieved among observers, coders, judges, or measuring instruments. Starting with the simplest kind of computation, Krippendorff's agreement coefficient is a tool to assess such agreement to embrace the most common forms, nominal data, several metrics, multiple observers, and incomplete data (Krippendorff, 2004: 211).

4. Data Analysis and Conclusion

The measure of Inter-Rater Agreement (IRA) with multiple observers will help researchers compare to know the coders' reliability has reached an equivalence reliability standard or not. It believes that if reliability coefficient exceed over 0.85, then coding result can be accepted as agreement (Kassarjian, 1977).

4.1 Subjects Structure and Classification

This research takes several weeks to consult 20 experts from March 1st 2021 to April 16th 2021 and collect 17 valid samples for distinguishing statement on this issue. In order to describe the basic features of this study, descriptive statistics are used to demonstrate the demographic variable about field, occupation, age, lifestyle, education and gender. In term of table 1 mentioned below:

Table 1 The Baseline of Samples Structure

Field	Population	%	Occupation	Population	%
Tea	13	76.47%	Public	1	5.88%
Seniority Avg.	9.13 yr.	-	Service	5	29.41%
Pottery	7	41.18%	Business	2	11.76%
Seniority Avg.	7.43 yr.	-	Freelance	2	11.76%
Healthcare	3	17. 65%	Housekeeping	-	-
Seniority Avg.	12.5 yr.	-	Retiree	4	23.53%
Multi-field	4	23.53%	Other	3	17.65%
Age	Population	%	Lifestyle	Population	%
Under 15	-	-	Artistic	9	52.94%
16-30	1	5.88%	Sports	2	11.76%
31-45	1	5.88%	Spirituality	-	-
46-60	14	82.35%	Technology	-	-
61-75	1	5.88%	Tourism	4	23.53%
Over 76	-	-	Home	2	11.76%
Education	Population	%	Gender	Population	%
College	8	47.06%	Male	4	23.53%
Master	9	52.94%	Female	13	76.47%

4.2 Consistency Reliability and Interpretation

The calculation of IRA is based on the formulation as:

Reliability = N*(Mutual Agreement AVG.)/ 1+[(N-1)*Mutual Agreement AVG.];

2M/N1+N2=The Mutual Agreement AVG. of the number of participants in CA;

N = Number of population involved in coding;

M = The number of decision population of mutual agree coders unanimously; and

N1+N2 = The total number of decision population that mutual agree to the coding.

Separately CA in Table 2 and 3, this study respect to the expertise opinions on the strength of correlation about each tea-and-ceramic SP on prescription with level of Strong (S), Middle (M) and Weak (W) in differentiation. On the tea-related case in Table 2, the top 5 curriculum of CAM in following sequence as: Leisure and Recreation therapy (S=13, M=3 and W=1), Food therapeutic healing (S=12, M=4 and W=1), Family therapy (S=10, M=5 and W=2), Landscaping horticulture therapy (S=7, M=6 and W=4), and Aromatherapy (S=9, M=2 and W=6) etc. On the pottery-related case in Table 3, the top 5 curriculum of CAM in following sequence as: Clay work therapy (S=15, M=1 and W=1), Leisure and Recreation therapy (S=10, M=5 and W=2), Landscaping horticulture therapy (S=9, M=6 and W=2), Painting therapy (S=6, M=9 and W=2), and Photography therapy (S=6, M=6 and W=5) etc.

Table 2 Tea-related Coding Unit of Mutual Agreement

Tea related	N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11	N12	N13	N14	N15	N16	N17	S	M	W
Music therapy	3	2	1	3	2	2	3	3	1	3	1	2	3	1	2	2	2	6	7	4
Clay work therapy	3	2	2	2	1	2	3	3	2	3	1	1	1	1	1	1	2	4	6	7
Narrative therapy	2	2	1	3	1	2	2	3	1	1	2	1	2	2	2	2	3	3	9	5
Sandplay therapy	2	1	1	1	1	1	1	1	2	1	1	1	1	1	2	1	3	1	3	13
Painting therapy	2	2	2	2	1	2	2	3	1	3	2	1	2	1	1	2	3	3	9	5
Dance therapy	1	2	2	2	2	2	2	1	1	2	1	1	3	1	1	1	2	1	8	8
Drama therapy	2	2	1	2	2	2	2	2	1	2	2	1	3	1	1	1	1	1	9	7
Photography therapy	2	2	1	2	2	2	2	3	2	2	2	1	1	1	3	1	1	2	9	6
Aromatherapy	1	3	3	3	1	3	1	3	1	3	3	1	3	1	2	2	3	9	2	6
Spiritual massage	1	2	3	2	1	1	1	1	2	3	3	1	2	1	1	3	2	4	5	8
Food therapeutic healing	3	3	3	3	3	3	1	3	2	3	3	3	3	2	2	3	2	12	4	1
Landscaping horticulture therapy	2	3	2	2	1	3	3	3	2	3	3	1	1	1	3	2	2	7	6	4
Animal therapy	1	2	1	2	1	1	2	2	1	1	1	1	3	1	1	1	2	1	5	11
Pastoral Healing	1	2	1	2	1	2	1	1	2	1	3	1	3	1	1	2	1	2	5	10
Hypnotherapy	1	2	1	3	2	1	1	2	1	3	3	1	2	1	1	1	1	3	4	10
Laughter Yoga	1	3	1	1	1	1	2	1	1	3	1	1	3	1	1	1	3	4	1	12
Physical work	2	2	3	3	1	1	1	3	3	3	1	2	2	1	2	2	2	5	7	5
Family therapy	2	3	3	3	2	3	2	3	2	3	3	2	1	1	3	3	3	10	5	2
Leisure and Recreation therapy	2	3	3	3	2	3	3	3	2	3	3	3	3	1	3	3	3	13	3	1
Existence treatment therapy	2	3	1	2	1	3	1	2	2	3	2	1	2	1	1	3	1	4	6	7

Table 3 Pottery-related Coding Unit of Mutual Agreement

Pottery related	N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11	N12	N13	N14	N15	N16	N17	S	M	W
Music therapy	3	2	1	2	1	2	3	3	1	3	1	2	3	1	1	1	1	5	4	8
Clay work therapy	3	3	3	3	3	3	3	3	3	3	3	3	1	3	3	3	2	15	1	1
Narrative therapy	3	2	1	1	1	2	2	3	2	1	3	1	1	1	1	2	1	3	5	9
Sandplay therapy	2	1	3	2	2	1	1	2	2	1	3	3	2	1	3	1	2	4	7	6
Painting therapy	2	3	2	2	2	2	2	3	1	3	3	1	2	2	2	3	3	6	9	2
Dance therapy	1	2	1	1	1	2	2	1	1	2	1	1	3	1	1	1	2	1	5	11
Drama therapy	2	2	1	2	1	2	2	2	1	2	2	1	3	1	2	1	2	1	10	6
Photography therapy	3	2	1	2	1	2	2	3	2	2	3	1	3	1	3	1	3	6	6	5
Aromatherapy	2	3	1	3	1	1	1	1	1	3	1	1	3	1	2	1	3	5	2	10
Spiritual massage	1	2	1	2	1	3	1	1	2	3	1	1	2	1	1	2	2	2	6	9
Food therapeutic healing	3	1	1	2	1	2	1	1	1	3	1	3	3	1	2	1	2	4	4	9
Landscaping horticulture therapy	3	2	2	2	2	3	3	3	2	3	2	3	1	1	3	3	3	9	6	2
Animal therapy	1	2	1	1	1	1	2	1	1	1	2	1	3	1	1	1	2	1	4	12
Pastoral Healing	1	2	1	2	1	2	1	1	2	1	2	1	3	1	1	2	2	1	7	9
Hypnotherapy	1	2	1	1	1	1	1	2	1	3	1	1	2	1	1	1	3	2	3	12
Laughter Yoga	1	2	1	2	1	1	2	1	1	3	1	1	3	1	2	1	1	2	4	11
Physical work	2	2	1	1	2	1	1	2	3	3	1	2	2	1	3	2	2	3	8	6
Family therapy	2	2	3	2	1	2	2	1	2	3	1	2	1	1	2	1	3	3	8	6
Leisure and Recreation therapy	2	2	3	2	1	3	3	3	2	3	2	3	3	1	3	3	3	10	5	2
Existence treatment therapy	1	3	2	1	3	3	1	2	2	3	3	3	2	1	1	3	2	5	5	7

Compare these findings to "Leisure Agriculture" (LA) in rural community, it’s easy to find that 4 curriculums among CAM are quite similar to LA usual courses, including Leisure and Recreation Therapy (LRT under tea-related), Landscaping Horticulture Therapy (LHT under pottery-related), Clay Work Therapy (CWT under pottery-related) and Food Therapeutic Healing (FTH under tea-related) etc. The CA consistency reliability calculation for LRT is reaching to 96.27 %, LHT is reaching to 91.32 %, CWT is reaching to 98.29 % and FTH is reaching to 90.12 %. In the light of IRA standard, all the LRT, LHT, CWT and FTH are high exceeding over the accepted 85 % level. In other words, the research subject of Xiangcun community in this study could be approved to be a tea-and-ceramic SP paradigm on prescription even greater SROI every now and then.

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Entrepreneurial Factors in Agribusiness

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Abstract

While farmers have been considered entrepreneurs in the past as they take great risks, little attempt has been made to apply concepts from the entrepreneurship literature to agriculture. It is conceded given the nature of different industries, differ the stakeholders and elements in an ecosystem that facilitate entrepreneurial growth are specific to a particular industry. Hence the concepts might not be as readily applicable to the agricultural industry, which is characterized by great fluctuations tied to natural conditions. This paper explores concepts from the entrepreneurship literature which are pertinent to agribusinesses around the world in building ecosystems that foster agribusiness development and growth. The aim is to recommend the key elements required for an agribusiness enterprise ecosystem to function and identify areas for further research.

Keywords: *entrepreneurial ecosystems; agribusiness; infrastructure*

1. Introduction

Agriculture is distinct from other industries in that it has high levels of risk and uncertainty compared with other industries in the secondary and tertiary sectors, with risks stemming from four main factors: first, risk from uncontrollable natural elements including weather; second, the risk from fluctuating market - that risks surrounding uncertainty in prices, outputs, and yields; third, risk from loss of labor due to unforeseeable circumstances; and fourth, risk from public policies relating to industry regulations, taxes, interest rates, and so on (Aimin, 2010).

Agriculture is also an essential industry in that it is intricately linked with nutrition and food security, as evidenced by the second Sustainable Development Goal (SDG) of the United Nations, which pledges to "End hunger, achieve food security and improved nutrition and promote sustainable agriculture" by 2030, while noting that "more than 790 million people (11%) still lack regular access to adequate food in 2014-2016"; furthermore, the proportion of government expenditures spent on agriculture is increasingly lagging behind its considerable economic contribution (United Nations, 2021). In their study encompassing 25 countries, Cervantes-Godoy & Dewbre (2010) also noted that advances in the agricultural industry and agricultural sector growth are positively associated with poverty reduction.

Jones & Ejeta (2016) believe that a productive and sustainable agriculture industry is indispensable for human health and nutrition, especially as many countries which have reduced undernutrition are now simultaneously facing challenges related to obesity. Staple food crops (the main three being rice, maize, and wheat) account for two-thirds of dietary intake worldwide, not to mention the diverse supply of fruits, vegetables, and other edible plants. Additionally, agriculture is playing an increasing role in emerging industries such as biofuels, so our reliance on agriculture in the future will likely increase.

Given agriculture's importance in our everyday lives, economic development, and policy implications, it is understandable that there has been increasing attention on agricultural innovations over the past few years, particularly in the field of information technology, with "precision agriculture" being of especial interest as a way to combat the various variabilities faced by the industry, the most common being yield variability, field variability, soil variability, crop variability, disease and damage variability, and management variability (Zhang, Wang, & Wang, 2002).

However, in consideration of the complexities and unique features of agriculture, there are comparatively fewer studies that explore the agriculture industry, or agribusinesses, from an entrepreneurship perspective, despite the fact that entrepreneurship is vital for attracting fresh talent and injecting new practices within any industry. This study seeks to compile findings from existing literature and propose some avenues worthy of further examination.

The area that offers benefits to agribusiness is the concept of enterprise ecosystems. Most governments seeking to develop enterprises and entrepreneurs seek to establish ecosystems that nurture and enable grown. It is a concept no unknown to agriculture but borrowed therefrom and ought to make a greater impact at its source. The paper seeks to explore enterprise ecosystems to evaluate the possibility of elements being introduced for the agribusiness industry.

2. Entrepreneurial Systems and Theories

The earliest studies on entrepreneurship systems focused on *infrastructures*, composed of the various tangible and intangible assets required by a company or industry to operate efficiently within an economy. Van de Ven (1993) stated that entrepreneurial infrastructures encompassed institutional processes, public resource endowments, and proprietary R&D, manufacturing, marketing, and distribution.

Expanding upon this theory, Gnyawali & Fogel (1994) proposed the concept of entrepreneurial *environments* which include the various economic, sociocultural, political factors supporting entrepreneurial activities.

A third, and increasingly popular framework is that of entrepreneurial *ecosystems* composed of site-specific interdependent actors and factors which may include factors relating to policy, finance, culture, supports, human capital, and markets (Stam, 2015; Isenberg, 2011).

Regardless of whether one chooses to approach entrepreneurship from an infrastructure, environment, or ecosystem perspective, what is clear from all three frameworks is the significance governments hold in building foundations for entrepreneurship within an industry.

3. Studies on Entrepreneurship in Agriculture

There have been a number of studies examining entrepreneurship factors in agriculture in different regions of the world. Mensah, Jianlin, & Jun (2019) found a significant positive correlation between agribusiness development in China with rural education, R&D, legalities, development of family households, intellectual properties, rural investment, the family system, and favorable protection for intellectual properties. Education, in particular, was considered to be essential for equipping rural farmers with business acumen.

Studies from Ghana and Nigeria (Adobor, 2020; Nwibo & Okorie, 2013) found that social structures were found to be negatively associated with entrepreneurial behavior because strong social ties among farmer-entrepreneurs often lead to innovation-slowing knowledge sharing. A lack of institutional support can also adversely affect agricultural entrepreneurship. Unemployment, profits, financial independence, population, self-employment experience, and

market proximity are all major determinants of entrepreneurship. Demographic factors such as age, education, annual income, and household size had positive effects on entrepreneurship, as did household entrepreneurial history and sources of capital. Furthermore, favorable government macroeconomic measures were also found to be beneficial.

Studies from higher income regions such as the UK and Wales (Ibeh, 2005; Bowen & Morris, 2019) found that international orientation, experiential knowledge, state-of-the-art facilities, and requisite competencies enhanced agribusiness development. In particular, expertise of top management was essential for forming an entrepreneurial environment, and smaller agribusinesses were recommended to engage in strategic collaborations with public organizations and foreign partners from niche locations such as China, Eastern Europe, and Africa. Policy makers play a critical role in providing relevant training, raising awareness of benefits from ICT adoption, and establishment of digital infrastructure supports.

4. Discussion

Entrepreneurship is essential for innovations which can lead to industrial transformations and disruptions. Though there have been comparatively few studies exploring the concept of entrepreneurship in agriculture, which was previously considered to be an unpredictable and volatile industry, more and more researchers are beginning to undertake relevant case studies across different countries, continents, regions, economies—this is obviously a universal issue of concern.

All studies commented upon the role of governments in supporting entrepreneurial activities in agribusinesses—note the elevation from *agriculture* to *agribusiness* following the establishment of an entrepreneur-friendly infrastructure, environment, or ecosystem. Governments can and should take a leading role in building entrepreneurial infrastructures and factors for agribusinesses, bearing in mind that agriculture is the basis upon which secondary and tertiary industries rely, as well as the significant role agriculture plays in nutrition, food security, poverty, and obesity.

However, this emphasis on government policy in agribusiness entrepreneurship raises a number of questions. Given that government expenditures have continued to drop in recent years, it seems reasonable to ask: what roles can other entrepreneur infrastructure/ environment/ecosystem actors play if the government refuses to take an active part in building entrepreneurial support systems for agribusinesses? Is it possible for the private sector to take on the role of government in this scenario? If yes, what sort of business models should be employed to ensure profitable, and therefore sustainable, operations? Is it possible for a single player to complete this task, or would complex collaborations between multiple parties be

required?

Moving on to the perspective of individual entrepreneur-farmers, what skills or expertise would be essential in ensuring the success of agribusinesses, and through what channels could these skills and expertise be obtained? Would it be possible to build a successful agribusiness in the absence of other infrastructure/environment/ecosystem actors, if an entrepreneur-farmer was sufficiently motivated?

In summary, even though there is an increasing number of studies examining agriculture and agribusinesses from an entrepreneurial perspective, there are still many gaps to be filled and areas to be explored. Considering the importance that agriculture holds now and will increasingly hold in the future. We believe these studies to be of paramount significance.

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A Review and Research Agenda for Social Entrepreneurship

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Abstract

Hybrid organizations of social enterprises are continuously developed in the world and prior literatures also pointed out the multi-dimensional characteristics of social enterprises. Social innovation focuses on interdisciplinary practices and attempts to seek out innovative model to solve social problem and create social value. This also happens on agriculture innovation. Unmet social needs bringing out some skills not developed by sectors may become important issue to cross-disciplines and variety skills learning of social entrepreneurship. Traditional earned-income model of management teaching in business school is not enough for rapid environmental change. Innovation and cross-disciplines learning are beneficial for solving social problem. It is interesting that prior literatures review can give us suggestion and reflection on future studies and find out the gap of existing and missing domains of research topics, research method and theories applied. This gap is worthy for us to investigate and synthesize relevant literatures on social entrepreneurship and is also our research purpose. Moreover, the systematic analysis is used and expected to gain the understanding of fundamental theory, methodology and popular topics in those literatures. Research result is expected to have reflection and contribution to educator and researchers, to promote the awareness of social entrepreneurship, and to diffuse innovation and creation to social wealth from social enterprises.

Keywords: *Social Entrepreneurship, Social Enterprise, Literature Review*

1. Introduction

In recent years, global industry, government and academia have begun to provide innovative, sustainable and efficient solutions to the unmet needs of agriculture and society. One company adopts innovative and entrepreneurial ways on social issues, which is called social enterprises. Social enterprise is a business or an organization with a social goal as its ambition, and the profits earned are then re-invested in the business to further support the social goal. One of the characteristics of social enterprises is that they generate social value instead of maximizing shareholders' interests. The legality of entrepreneurship bases on social issues and the forced marketization to the third sector promotes the formation of social enterprises (Engelke, Mauksch, Darkow & von der Gracht, 2015). Social enterprise is the product of social innovation and social diversification in terms of environmental protection, agricultural and rural society development, social welfare etc. Social enterprises in Taiwan are generally complimented on their efforts to social and environmental concerns.

Researches on social enterprises has increased rapidly in recent years, and Dees (2007) advocated researchers should pay attention to the field of social enterprises. Many papers about social enterprise were published in academic conference theme and peer review journals. These academic activities help us understand the theory, provide practical evidence, and synthesize the definitions and research scopes of social enterprises (Gonin, Besharov, Smith & Gachet, 2012).

Sassmannshause and Volkmann (2016) also argued that social entrepreneurship is a mature research field. The results of the study showed that the literature on social entrepreneurship has grown exponentially from the first in 1954 to after 2006, which is a steep curve of rapid growth. In 2013, as many as 3870 articles were published. They used 7 indicators proposed by Scientometric to explain that the institutionalization of social entrepreneurship in academia has strictly become a mature academic field. These 7 indicators included the emergence of specific journals, the research topics of social entrepreneurship were accepted by leading journals and edited into monographic books or research collections, which continue every year. The development of conference seminars and workshops, teaching materials and teaching plans, the emergence of academic centers and research institutions, and finally the integration of themes into qualified courses.

From the past literature, it is found that social enterprise education can be divided into three major directions: the global survey of social enterprise curriculum, theories and concepts on social enterprise education, and introduction of teaching cases and the discussion of innovative models of teaching strategies. It is interesting that prior literatures review can give us suggestion and reflection on future studies and find out the gap between extant and missing domains of research topics, research methodology and theories applied. This

phenomenon is worthy for us to investigate and synthesize relevant literatures on social entrepreneurship and it is our research purpose.

2. Research Reviews of Social Enterprise and Social Entrepreneurship

Some researches about social enterprise and social entrepreneurship have been used to illustrate the development and future trends of social enterprise research. Salamzadeh, Azimi and Kirby (2013) conducted a questionnaire survey of master students from three academic programs (entrepreneurship, management and engineering) in the University of Tehran in Iran, and to assess their perceptions to social entrepreneurship. The structure of the questionnaire included awareness of social entrepreneurship, entrepreneurial intentions and support for social entrepreneurship, and the content of social entrepreneurship. In the first part of the definition of social entrepreneurship, 5 scholars' definitions of social entrepreneurship were listed and students needed to rate with their agreement with the definition of social entrepreneurship among 5 scholars. They are Leadbeater (1997), Dees (1998), Drayton (2002), Mair and Marti (2006) and Salamzadeh et al. (2011). Finally, Dees (1998)'s definition of social entrepreneurship was most accepted by master students. But as for the cognition of social entrepreneurship institutions, up to 20% of the participants chose not to answer. Compared with entrepreneurial students (45.2%), only 33.8% of non-entrepreneurship programs (management and engineering programs) hope to start their own businesses. The major factor in choosing not to start a business or to invest in social entrepreneurship is regarded as capital, and it is also the factor to students needing support and assistance mostly.

The research scope of Granados, Hlupic, Coakes and Mohamed (2011) is mainly based on the background of social sciences, and explores the prior researches in the field of social sciences on social enterprises, social entrepreneurship or social entrepreneurs. In addition to the 3 keywords, the terms of community enterprise and social venture are also included. The three main important international databases for the study are Scopus, ISI Web of Knowledge, Business Source Complete, and two journals in Science Direct are Social Enterprise Journal and Journal of Social Entrepreneurship. The settings for retrieving are limited to academic journal articles, the language is English, and the relevance of the settings is on the columns of abstract, title, keywords and research topic. From 1991 to 2010, a total of 286 related journal articles were retrieved. There were 464 authors and 264 organizations in 35 countries, but 61% were concentrated in the United States and the United Kingdom. The research result shows that the major journals are classified in business, management and entrepreneurial fields. This study applied descriptive method and bibliometrics to summarize the intellectual structures among the related researches about social entrepreneurship. The results of the

analysis can identify meaningful structures and patterns of authors relationship and epistemological orientation and areas among journals.

Sassmannshause and Volkmann (2016) applied bibliometrics to retrieve a large number of relevant articles and identify the most frequently cited publications, and used content analysis to evaluate research popular area and less popular fields. The database used in the study is EBSCO, ScienceDirect and Google Scholar. The retrieving time is December 2013, and the search keyword is Social entrepreneurship. The research findings are indicated 5 aspects of academic and scientific progress. It explains the development and expansion of theoretical ontology, the increasing number of the academic institutions, the emergence of thematic clusters, the advance of research methodology, and finally the impact of citations. The results of this study are similar to the findings of Granados, Hlupic, Coakes, and Mohamed (2011). Most of the researches lack quantitative empirical methods and are based on qualitative methods. Case studies and narrative stories are usually simplified and used as examples of theoretical concepts in researches of social entrepreneurship, rather than theoretical built. Usually narrative stories and other methods of qualitative research are very important tools in strengthening the understanding the field. However, qualitative research sampling which is usually based on the social network relationship of authors seems to be opportunity and convenient-oriented. Sassmannshause and Volkmann suggest that it is necessary to strengthen research methodology on data collection process in the further studies, especially for descriptive stories, Interviews, case studies and anthropological research. Quantitative researches on social entrepreneurship are very limited, and lacks a basis of sufficient amount. Therefore, the quantitative measurement is the biggest challenge for current research of social entrepreneurship. They also suggest that the balanced scorecard can be used to develop and evaluate the influence of social enterprises, or to use continuous-scale quantitative analysis to identify social and business entrepreneurship. Sassmannshause and Volkmann (2016) summarized 22 highly-cited articles that are the most influential in social enterprise researches, of which 15 are the same as the 20 top rankings of the importance of highly cited articles synthesized by Kraus, Filser, O'Dwyer and Shaw (2014). In these 15 articles, Kraus, Filser, O'Dwyer and Shaw (2014) classified into 5 major research topics of social entrepreneurship, namely definition and conceptual approach, impetus, personality, impact and performance, and future research agenda, as shown in Table 1:

Table 1 5 major research topics of social entrepreneurship

	Group Topics	The representative literature
1	Definition and conceptual approach	Austin, Stevenson and Wei-Skillern (2006), Weerawardena and Mort (2006), Martin and Osberg (2007), Mort, Weerawardena and Carnegie (2003)
2	Impetus	Bornstin (2004), Dees, Emerson and Economy (2001)
3	Personality	Leadbeater (1997), Thompson, Alvy and Lees (2000), Thompson (2002)
4	Impact and performance	Alvord, Brown and Letts (2004), Dart (2004)
5	Future research agenda	Mair and Marti (2006), Peredo and McLean (2006), Nicholls (2006)

Different from the clustering by highly citation, Sassmannshause and Volkmann (2016) grouped 158 research articles on social entrepreneurship into 14 themes based on the titles, keywords, and abstracts. 59.5% of total are including definitions, theoretical constructs or structures of social entrepreneurship, understanding or description of phenomena, features, and classifications. The second major theme is measuring the social impact of social entrepreneurship, social value creation, performance or other results, accounting for 29.1% of the total. The third theme is resources, social entrepreneurship supporting and finance, and decision-making by social investors. The fourth theme is the network and community of social entrepreneurship, and the fifth theme is discussed from the perspective of organizational theory. These three categories are 26.6%, 20.3%, and 20.2% respectively. The remaining categories are the process of social entrepreneurship, social entrepreneurs and their motivations, methods and psychology, reviews of social entrepreneurship research, reports and interviews of social entrepreneurship, identification and development of social opportunities, social entrepreneurship education, and social innovation, book reviews, interviews, forum commitments, comments and notes, and finally others. The classified themes of this study add up to more than 100% because some studies cross several categories.

Another research of social enterprise education, Wu, Kuo & Shen (2013) explored how business schools teach the topic of social entrepreneurship based on web-based investigation by content analysis. The purpose of the research is to understand how global business schools implement social entrepreneurship education. The online surveys investigate course syllabus in 100 business schools listed on The Beyond Grey Pinstripes (BGP) Global around the world in the 2009-2010. They found that most social enterprise courses are set up in research institutes, and the School of Business and Management become the major center for cultivating talents for social entrepreneurship.

3. Conclusion

In recent years, the researches of social enterprise have been diversified and rapidly increased. The field is becoming more mature and more visible in university campus courses. Past literature has given us a multi-faceted understanding of social enterprises. Social enterprises has the unique characteristic with mixed organizational forms continue to develop globally. There are some successful cases of social enterprise about farm in city and waste reducing, for example, Prinzessinnengarten and Original Unverpackt in Berlin, Germany, The Au Bout du Champ in France and the transformation of the mountain town Tontnes in the UK. Consumers take into account food safety, environmental protection, and reducing greenhouse gas emissions during food delivery gradually. Au Bout du Champ in France is the case of consumers buying directly from small farmers by vending machines. Eating food locally has become a consumption phenomenon. The farm garden of Prinzessinnengarten in Berlin is the famous and mysterious base of top 10 urban farm innovations in the world. Finally, the researches of social entrepreneurship have been continuing studied and explored by worldwide scholars. Gupta, Chauhan, Paul and Jaiswal (2020) presented a systematic review of 188 articles published in 2007-2018 in SSCI journals and classified in 6 main themes namely SE phenomenon (16%), entrepreneurial orientation (15%), innovation and SE (10%), human resources in SE (24%), business strategy and value creation (18%), and challenges faces by social entrepreneurs (18%). The findings of research themes are compared with past literature mentioned in section 2, and the popular research themes are more specific and tangible on the business operations and functions of SE. The review and research agenda for social entrepreneurship is expected to have reflection and contribution to educator and researchers, to promote the awareness of social entrepreneurship, and to diffuse innovation and creation to social wealth from social enterprises.

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Analysis of Factors Affecting Pasture Fires

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Abstract

According to the Center for Fire Statistics, there are about 50 million forest and steppe fires in the world each year. The periods from March 20 to June 10 and from September 20 to November 10 of each year in Mongolia are considered to be “Fire Hazard Periods” with dry weather conditions, favorable for forest and steppe fires. The analysis was done using Terra / MODIS satellite data during these months over the 2005-2020 years. The study area is Dornod province which has the highest events of forest and steppe fires in 2015. The events of forest and steppe fires have also increased since then and from the previous years. The study used satellite data and ArcGIS software to estimate modified soil-adjusted vegetation index, normalized difference vegetation index, and land surface temperature. Linear and nonlinear multi-factor regression analysis was applied to model the modified soil-adjusted vegetation index based on normalized difference vegetation index, land surface temperature, air temperature, wind speed, and precipitation for fire monitoring. The results show that the regression analysis, the modified soil-adjusted vegetation index in autumn depends on the factors such as normalized difference vegetation index, land surface temperature, air temperature, and precipitation, whereas land surface temperature, wind speed, and precipitation are the main factors in springtime. The output model’s coefficient of determination, which indicates the correctness of the regression equation ranges from 0.81 to 0.89.

Keywords: *Fire monitoring, satellite data, climate data*

1. Introduction

Forest and steppe fires are caused by lightning, electricity, overheating, and human error in forest and steppe. According to the Center for Fire Statistics, there are about 50 million forest and steppe fires in the world each year.

Natural fires are fires that burn uncontrolled in settlements, buildings, rural vegetation, and other areas. These include meadows, swamps, grasslands, shrubs, and forested areas.

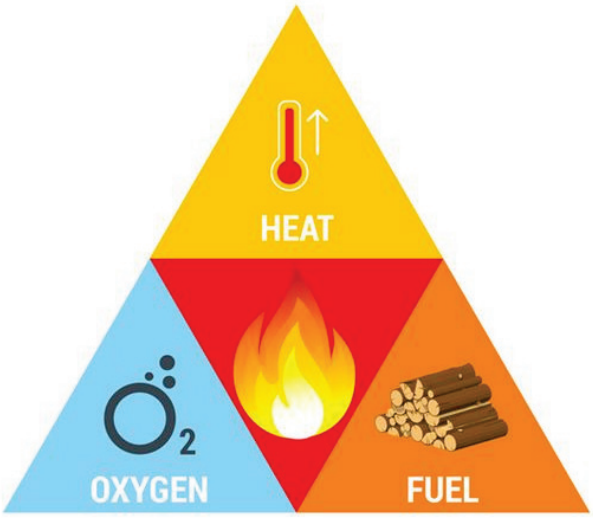

Figure 1 Fire triangle

The combination of the three elements that make up a fire, oxygen, heat, and combustible materials, is called a fire triangle, and the elimination of one of these elements extinguishes the fire. Oxygen is an air component that activates the combustion of combustible materials. The main factor influencing the state of natural fires is air or wind.

Heat is the energy required for the combustion of a body by the combustion of combustible materials with oxygen and the evaporation of moisture. Combustible materials can be ignited in a variety of ways. Combustible materials are all combustible materials that are part of any plant and that emit heat during combustion. The type, shape, quantity, distribution, and moisture content of the combustible material affect the state of the fire [1].

Forest and steppe fires have a direct impact on ecosystem biodiversity. Fires kill species of plants and animals, as well as other organisms such as fungi, mosses, lichens, and ferns. Forests and other ecosystems are sources of food, medicine, genetics, and industrial resources that can be used sustainably. By destroying species in ecosystems, forest and steppe fires lead to the loss of these resources. Loss of forest resources, infrastructure, health problems, human resettlement, and subsequent rehabilitation can also lead to economic losses [2]. Periods from March 20 to June 10 and from September 20 to November 10 in Mongolia are considered ‘Fire risk periods’ with favorable dry weather conditions for forest and steppe fires. Based on this,

March, April and May are considered the spring seasons and September, October, and November are the autumn seasons. The purpose of this study was to analyze the many factors that contribute to pasture fires in Dornod province.

2. Study Area

The study area is Dornod province, located in the eastern part of Mongolia (Figure 2). It covers the east-central Asian grassland steppe. The total area of Dornod province is 123.5 thousand square kilometers and geographically it is mainly the steppe, located 560 - 1,300 m above sea level. The average annual rainfall is 150~300 mm, it occurs during summertime. About 90% of the total area is a steppe with hills. Bordered by Russia to the north and China to the east and southeast [3].

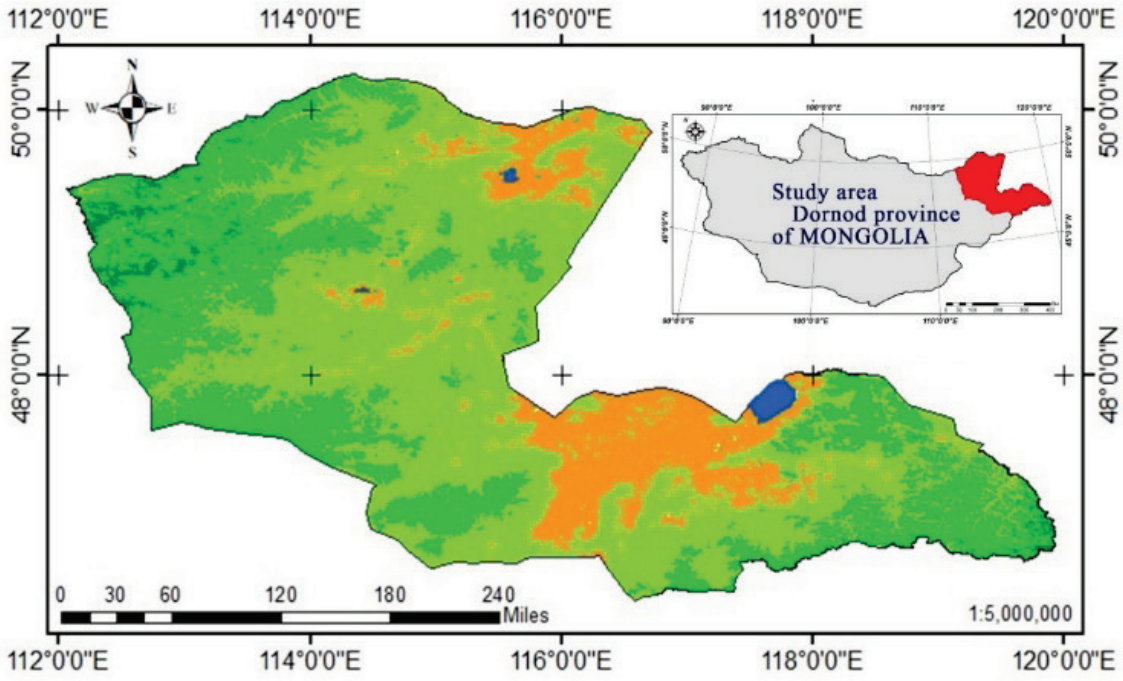

Figure 2 Study area: Dornod province

3. Data

Climate data, such as spring and fall precipitation, wind speed, and air temperature for 2005-2020, were used from the Mongolian statistical information service [4].The study used MODIS (Moderate Resolution Imaging Spectroradiometer) satellite data for spring and fall 2000-2020.

Table 1 The MODIS satellite used data

Terra/MODIS Product code	Product name	Spatial resolution(m)	Temporal resolution(days)
MOD09A1.006	RED	500	8
MOD09A1.006	NIR	500	8
MOD11A2.006	LST	1000	8
MOD13Q1.006	NDVI	250	16

Source: https://lpdaacsvc.cr.usgs.gov/appeears/

4. Methodology

4.1 Modified Soil-Adjusted Vegetation Index / MSAVI

In 1994, Kee and other scientists studied the dynamics of the L factor based on SAVI and developed the next advanced version that could be used in imaging, called the Modified Soil Adjusted Vegetation Index (MSAVI) which can be formulated in the following formula.

$$\boldsymbol{MSAVI} = \frac{(\boldsymbol{NIR} - \boldsymbol{Red})}{(\boldsymbol{NIR} + \boldsymbol{Red} + \boldsymbol{L})} * (\mathbf{1} + \boldsymbol{L}) \quad (1)$$

where L is a soil reflectance correction factor (const=0.5)

Regression is a statistical method that constructs a function that allows an analyst or statistician to make predictions about one variable based on the information that is known about other variables. Multiple Linear Regression, also known simply as multiple regression, is a statistical technique that uses several (two or more) explanatory variables to predict the outcome (or function, or model) of a response variable.

The general formula of multiple Linear Regression model is

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_n x_n \quad (2)$$

and nonlinear regression model or the general form of the Cobb-Douglas function with multivariable is:

$$\mathrm{y} = \mathrm{A}\mathrm{x}_1^{\alpha_1}\mathrm{x}_2^{\alpha_2}\mathrm{x}_3^{\alpha_3}\cdots\mathrm{x}_\mathrm{n}^{\alpha_\mathrm{n}}, \quad (\mathrm{A}, \alpha_\mathrm{i} < 1, [\mathrm{i} = \overline{1,\mathrm{n}}]\text{-constant}) \quad (3)$$

where y - response (dependent) variable, $\mathrm{x_i}$ $(i = 1,2,\dots,n)$ - explanatory (independent) variables.

If we take a natural logarithm from both sides of this equation, we have the following linear form:

$$\ln \mathrm{y} = \ln \mathrm{A} + \alpha_1 \ln \mathrm{x}_1 + \alpha_2 \ln \mathrm{x}_2 + \cdots + \alpha_\mathrm{n} \ln \mathrm{x}_\mathrm{n} \quad (4)$$

where α_i $(i = 1,2,\dots,n)$ indicate the sensitivities of the variables. Sensitivity refers to the percentage change in the variable i when a variable is changed by 1 percent [6].

In general, the model can be written as follows.

$$MSAVI = f(NDVI, LST, AT, \mathrm{WS}, \mathrm{P}) \tag{5}$$

Desertification and degradation in the area are highly dependent on soil moisture. Scientists in many countries use MSAVI for degradation research. MSAVI, on the other hand, can determine the dryness. Linear and nonlinear multi-factor regression analyses are made to model the modified soil-dependent vegetation index (MSAVI) based on normalized difference vegetation index (NDVI), land surface temperature (LST), air temperature (AT), wind speed (WS), and precipitation (P), as high aridity leads to fires.

5. Result

Figure 3 shows the events of forest and steppe fires in Dornod province in 2000-2019. In 2000, 29 fires were registered in Dornod province, while in 2013 and 2014 there was only one event fire. In 2015, the highest fire events were recorded. In general, in 2015-2020, there were more fires than in previous years.

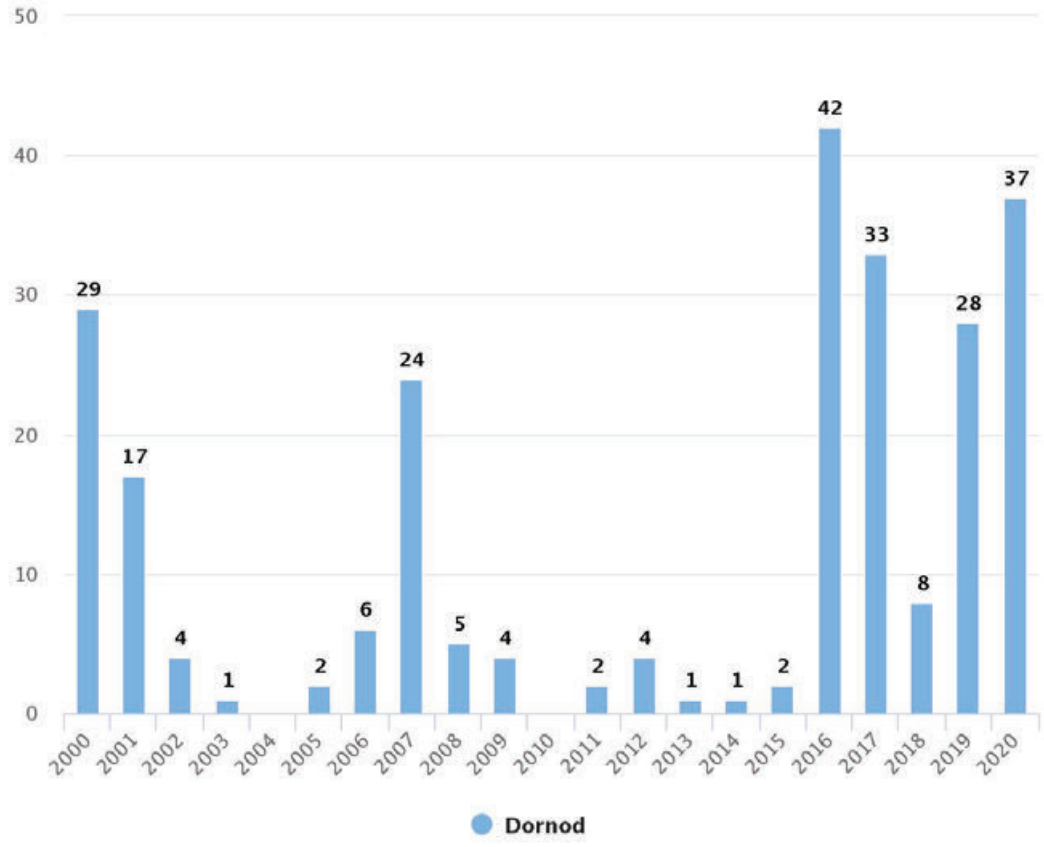

Figure 3 The number of forest and steppe fires in Dornod province

Due to the high events of fires in Dornod province in 2015, the following figure 4 shows the changes in MSAVI in April-October of this year. When comparing the 2015 MSAVI value with the values of other years, for example, in April 2015 it was 0.10893, which is an increase of 5.6% from the value 2010.

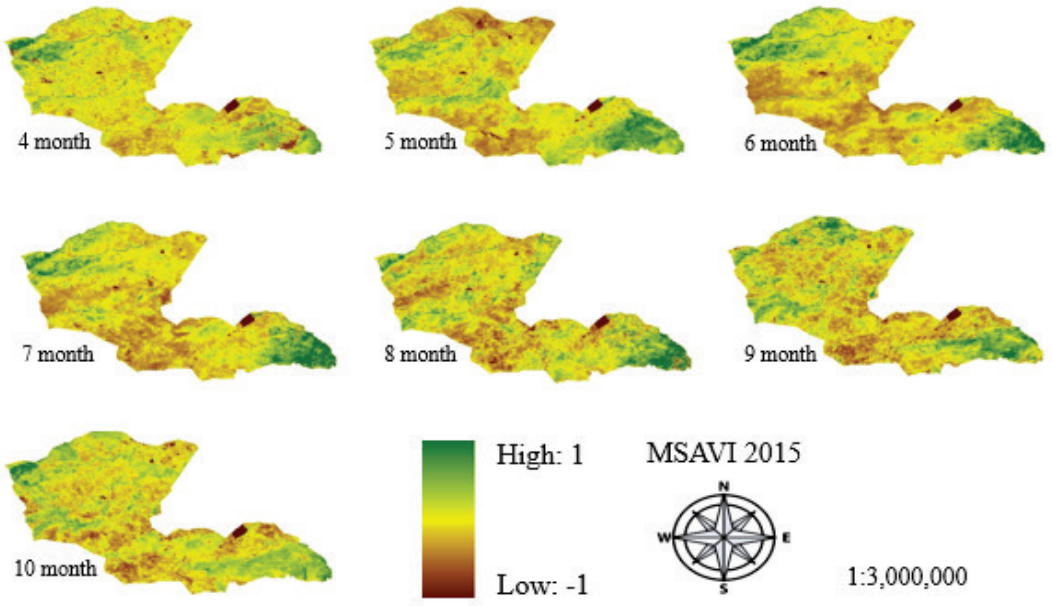

Figure 4 Map of the MSAVI in 2015

By 2020, the modified soil-dependent vegetation index has decreased by 12.71 percent since 2000. In other words, there is an increase in aridity. For MSAVI, NDVI, LST, precipitation, wind speed, and air temperature data, the 3, 4, and 5-month averages were taken as spring seasons, and Figure 5 and Figure 6 show the long-years changes in the factors. During 2005-2020, most indicators tend to increase on average.

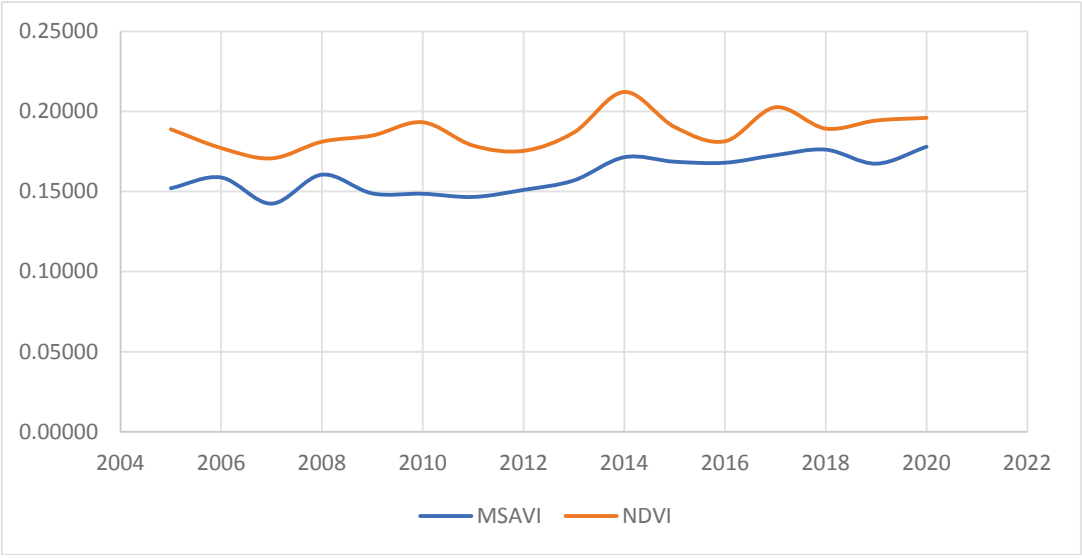

Figure 5 Patterns of MSAVI and NDVI during spring

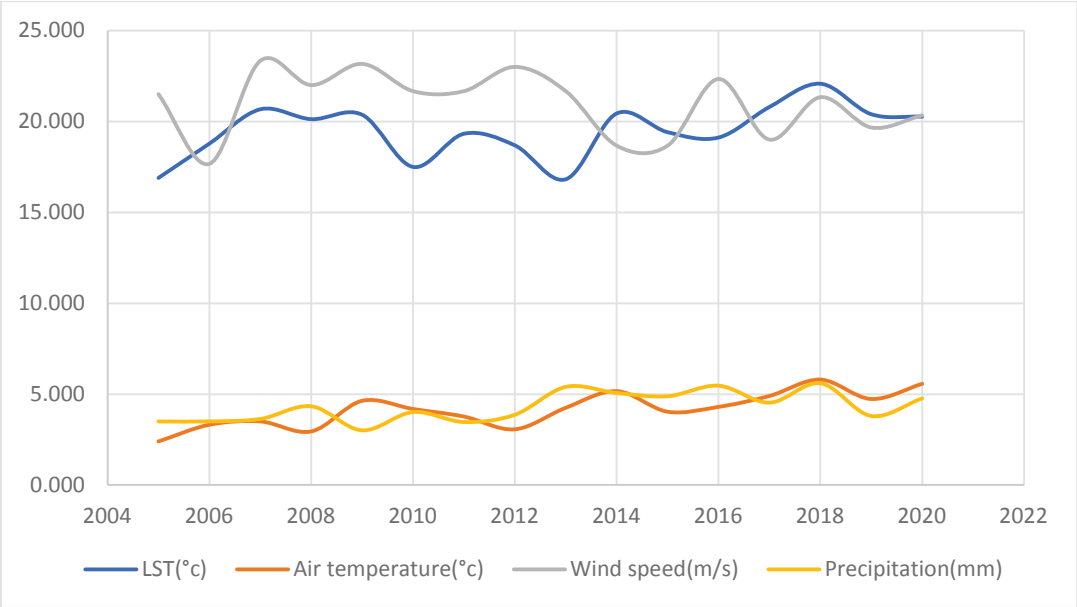

Figure 6 Patterns of factors during spring

Figure 5 shows that MSAVI and NDVI have low volatility, with the average value of this factor slightly increasing. Also, as shown in Figure 6, LST and wind speed have higher standard deviations than other factors.

Table 2 shows the correlations between the factors used in the study, such as modified soil-dependent vegetation index (MSAVI), Normalized Difference Vegetation Index (NDVI), land surface temperature (LST), precipitation, wind speed, and air temperature.

Table 2 Correlation matrix for the spring season

	MSAVI	NDVI	LST(°c)	Air temperature (°c)	Wind speed(m/s)	Precipitation (mm)
MSAVI	1					
NDVI	0.637751	1				
LST(°c)	0.466838	0.178157	1			
Air temperature (°c)	0.679464	0.614016	0.585335	1		
Wind speed(m/s)	-0.59015	-0.56355	-0.11483	-0.26153	1	
Precipitation (mm)	0.712743	0.393661	0.147834	0.532893	-0.19359	1

As shown in Table 2, the dependence of MSAVI on NDVI, air temperature, and precipitation is higher than other factors. However, the wind speed is negatively correlated with MSAVI. Also, air temperature is multicollinearity with NDVI and LST. However, since the correlation is moderate, it is not considered necessary to perform a regression analysis on any variable with high dependence.

The averages for September, October and November averages are taken as the fall season, and the following figure shows the changes of the factors over the years. MSAVI and NDVI are on average increased and standard deviations are low.

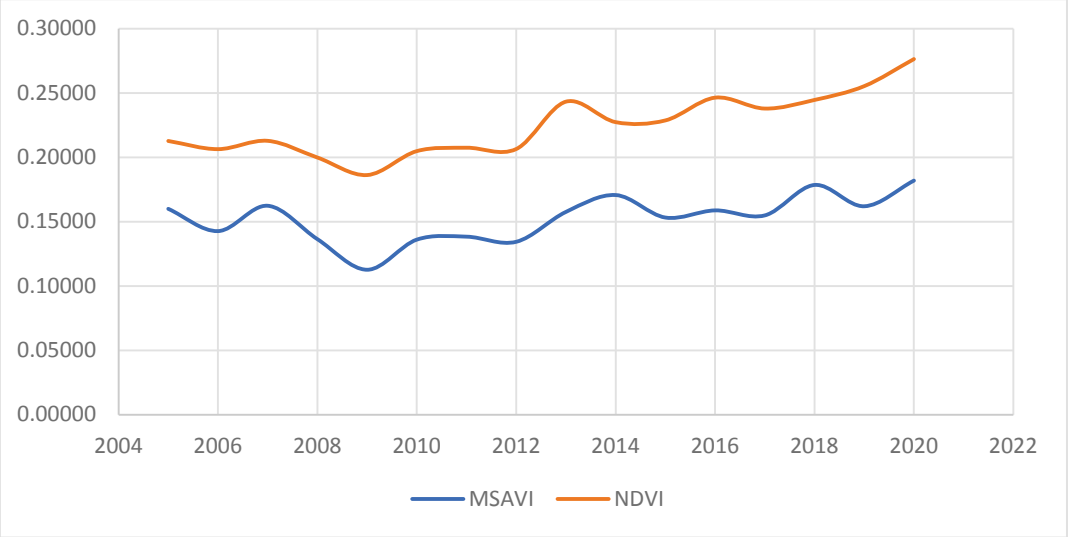

Figure 7 Patterns of MSAVI and NDVI during fall

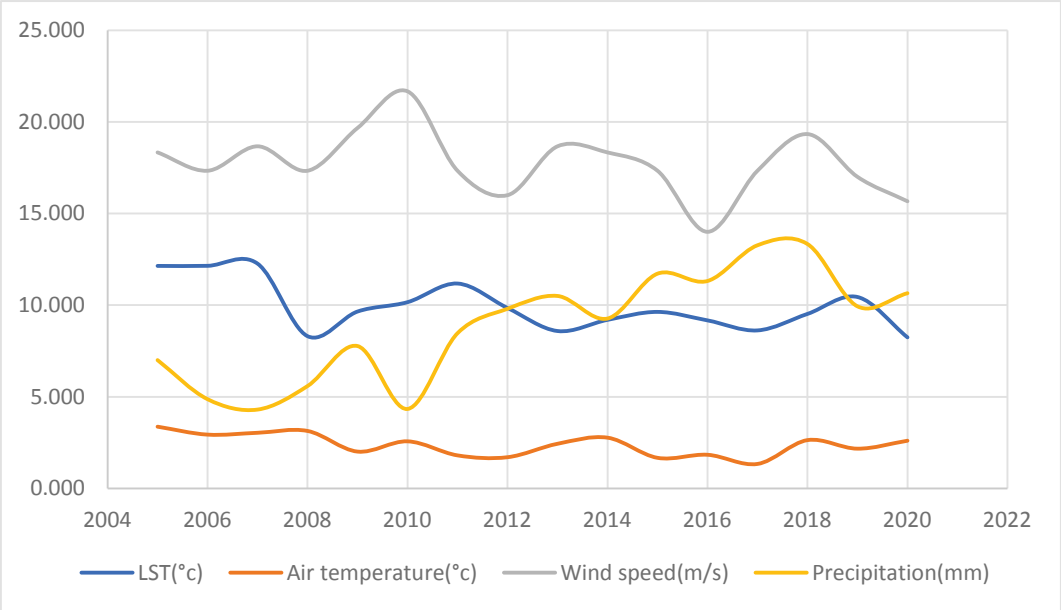

Figure 8 Patterns of factors during fall

As shown in Figure 7, LST, air temperature, and wind speed decreased on average. Additionally, LST, wind speed, and precipitation have higher standard deviations than other factors. Precipitation is higher in the fall than in the spring. Table 3 shows the correlation matrix of the factors in fall.

Table 3 Correlation matrix for the fall

	MSAVI	NDVI	LST(°c)	Air temperature (°c)	Wind speed (m/s)	Precipitation (mm)
MSAVI	1					
NDVI	0.8291	1				
LST(°c)	-0.13179	-0.42689	1			
Air temperature(°c)	0.24693	-0.14652	0.346503	1		
Wind speed(m/s)	-0.24075	-0.43949	0.20994	0.327788	1	
Precipitation (mm)	0.4452	0.664758	-0.57295	-0.61956	-0.39704	1

As shown in Table 3, MSAVI has a high dependence on NDVI. This is due to the fact that the vegetation in fall is higher than in spring. The results of the regression analysis are shown in Table 4.

Table 4 The results of the regression analysis

Dependent variables	MSAVI coefficient			
	Linear		Nonlinear	
	Spring	Fall	Spring	Fall
NDVI		0.538		1.0251
LST	0.00257	0.0032(**)	0.2954	
Air temperature		0.0163		0.1605
Wind speed	-0.00285		-0.35	
Precipitation	0.0081	0.0027	0.2219	
Intercept	0.135	-0.0628	0.1402	0.6155
R^2	0.826	0.894	0.817	0.823
(*) - 5%, (**) - 10% confidence level				

Regression analysis was performed using the spring and fall averages, and the outputs are summarized in the following table.

Table 5 Regression equation

Season	Regression equation	
	Linear	Nonlinear
Spring	$y = 1.35 + 0.0026x_2 - 0.0029x_4 + 0.0081x_5$	$y = 0.14x_2^{0.3}x_4^{-0.35}x_5^{0.22}$
Fall	$y = -0.063 + 0.538x_1 + 0.0032x_2 + 0.016x_3 + 0.0027x_5$	$y = 0.62x_1^{1.03}x_3^{0.16}$

where

y - MSAVI, x_1 - NDVI, x_2 - LST, x_3 - Air temperature, x_4 - Wind speed, x_5 - Precipitation

The models of spring and fall seasons depend on different factors depending on the season. For example, for the spring linear model, wind speed is negatively correlated, while LST and precipitation are positively correlated. Also, since spring plants and air temperatures are lower than in fall, they are less relevant or irrelevant to the spring model.

According to the results of the regression analysis, the modified soil-adjusted vegetation index in fall depends on variables such as NDVI, LST, air temperature and precipitation, while LST, wind speed and precipitation are the main factors in spring. For these models, the coefficient of determination, which indicates the correctness of the regression equation, ranges from 0.81 to 0.89. Changes in these independent variables can explain about 81- 89% of changes in the modified soil-adjusted vegetation index.

The following map also shows the dotted outline of linear and non-linear fire models in Dornod province in October 2015.

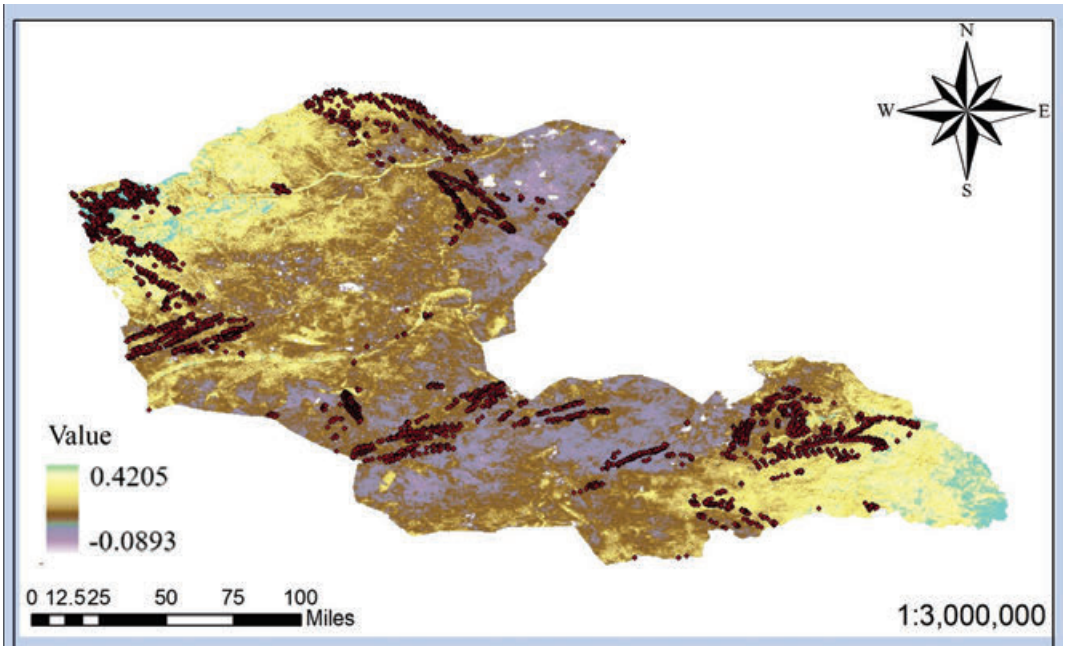

Figure 9 Linear Model Map

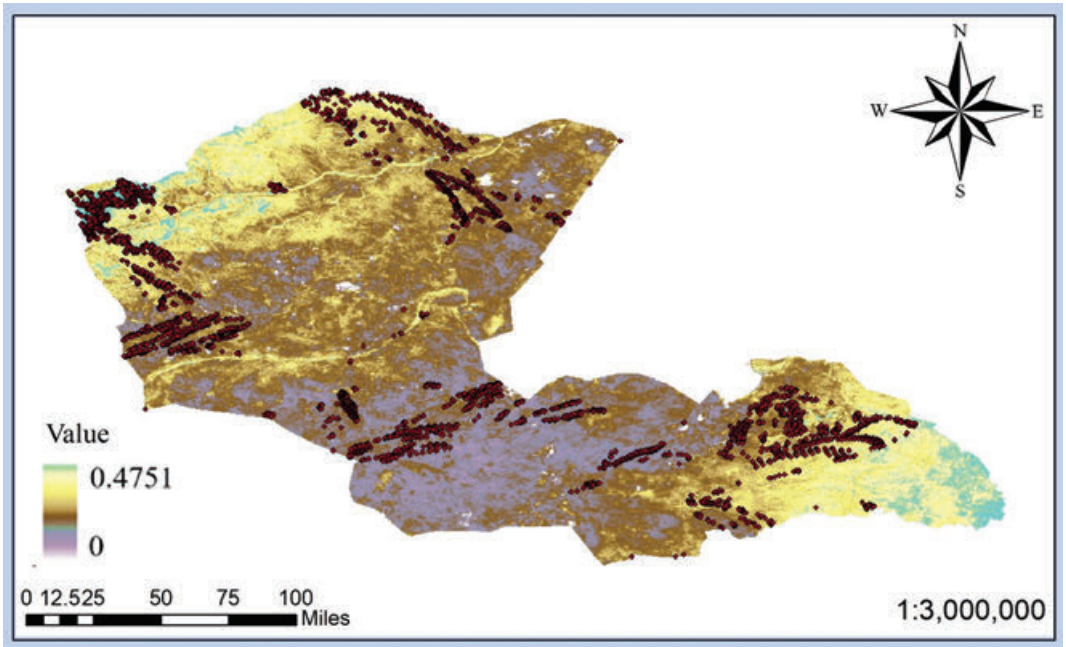

Figure 10 Nonlinear Model Map

Most of the fire events are within the 0-0.2 range of the MSAVI satellite data. There are a total of 3679 fire events points, and 3574 points or 97% of the total fire exit points are in the 0-0.2 interval of MSAVI satellite data. The fire points over the model map 88% for the linear model and 86% for the nonlinear model are in the 0-0.2 range.

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Branding of Agricultural Produce and Enhancing Farmers Income

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Abstract

Agriculture is demographically the broadest economic sector and plays a significant role in the overall socio-economic fabric of India. The country has been always known for producing diversified agricultural products and has the potential of being the biggest country with the food and agricultural sector but hardly 2% of the produce is processed. Agriculture in India has been organized on a local basis with often the local production meeting the local demand of Indian consumers. However, its diversity provides enough scope for the growth and export of many specific products required by other countries. However, farmers, corporate sector and all related agencies with marketing of farm produce have recognized the fact that the future economic prosperity demands a paradigm shift from offering commodity in simple form to differentiated goods and services to the consumers. Therefore, we need to understand and communicate, internally and externally, the essence of its brand. Branding of commodities will offer additional value both to the consumers and the producers. However, branding of "India" alone cannot bring the desired results of improving farmers' income. It is a big challenge. However, we need to remove some of our major weakness and need to take some corrective measures. This paper examines the current agricultural scenario in India and explores branding as an important strategic tool for enhancing the farmer's income in India. It also covers some of the challenges that Indian farming community is facing today, and strategies to enhance farmers' prosperity.

Keywords: *Agriculture, Branding, Commodities, Indian Consumers, Farmer's Income*

1. Introduction

India has been always known for producing diversified agricultural products and has the potential of being the biggest country with the food and agricultural sector. Indian agriculture suffers from a mismatch between food crops and cash crops, low yields per hectare except for wheat, volatility in production and wide disparities of productivity over regions and crops. Domestic production of pulses and oilseeds are still below the domestic requirements and India imports pulses and edible oils to satisfy domestic demand. Moreover, every year about 20 per cent of the crop is lost due to mishandling, spillage, floods, droughts and pests and diseases. Ironically, despite being world's leading producer of many agricultural commodities, often there is severe short supply of farm products in India. Over two billion people, most of whom are women and children, suffer due to severe malnutrition and micronutrients-deficiency. Thus, considering the fact that it is a large producer of many agricultural products, the country has not been able to develop itself as a major player in the field of agricultural products. For example, although India is the world's second largest producer of fruits and vegetables, but hardly 2% of the produce is processed. This is because India's food processing sector is at very infant stage and has still a long way to go. Branding of agricultural produce may be an answer to get higher price for our nation's agricultural products at the global and national level. However, it is a fact that we cannot export more, unless we have more to export. To overcome such issues and achieving food security, it is important that we increase our productivity and motivate our farmers to use modern farming techniques and modern marketing methods to lead to path of self-sufficiency. Since 70 percent of India's population lives in rural areas, it is essential to lay adequate emphasis on increasing agricultural productivity. Since per capita availability of land is less than 1.5 hectares, there are severe limitations to expanding employment opportunities in agriculture (Deepak & Gaurav, 2007). Also, greater focus on emerging areas in agriculture like horticulture, floriculture, organic farming, genetic engineering, food processing, attractive and useful packaging and of course, branding can lead to better price realization for the benefit of our farmers.

2. Objectives

The main objective of this paper is to examine the strategies for enhancing the income of farmers using branding as a tool; and to develop strategies and suggest policy initiatives that can lead to increase in the production, productivity, and profitability of Indian farmers.

3. Food Processing: Future of Indian Agriculture

The consumption patterns across the country have undergone a marked shift towards

higher consumption of meat at the expense of more traditional source of protein-pulses. The shift is reflective of the overall upward trajectory of the Indian economy with benefits of accelerated growth beginning to spread and thus alter food habits. Similarly, due to changing life style pattern, the demanded for packaged / processed and branded food products is growing. The branded foods market represents a significant opportunity for long term growth. Alongside growing per capita incomes, the Indian food consumption habit is expected to progressively evolve from basic foods to value added products. Changing consumer preferences and heightened quality awareness, together with the expected reform of the regulatory framework and tax structures, will provide necessary fillip to the food processing industry. It is to be noted that several structural changes (production scenario, per capita income, life style, dietary pattern, trade, and the like) are taking place in the country and traditional joint family structure is disintegrating towards individualization and nuclear families. In fact, whole family dynamics is changing and subsistence agriculture is moving towards commercial and market-driven enterprise leading to commercialization of output and inputs. Domestic market is also moving towards processed food products and demand for new products is increasing even in Indian market.

Recent trend of food basket is diversifying towards more high value commodities. More than 250 million strong middle class of dual income nuclear families with high disposable income - holds the key to future of the food market (Praduman and Mruthyunjaya 2005). Studies state that huge population is mostly dominated by the comparatively young people (25 years or younger (58%)) demand more new products. High and upper middle income groups are relatively small but fastest growing segments in terms of size. However, the challenge before the country is to harness the untapped potential of the identified agricultural sectors and create adequate forward and backward linkages to ensure citizen empowerment and sustainable economic development. Furthermore, substantial attention needs to be paid to the development of infrastructural facilities to ensure rapid industrial growth in the country. The diverse agro climatic conditions and the fertile land enable the growth of horticulture produce like fruit crops (from temperate to sub-tropical), flowers, vegetables, mushrooms, tea, medicinal and aromatic plants. It is known fact that majority of people residing in rural areas are directly or indirectly engaged in agriculture. Their socio-economic condition very much depends upon the income they receive from farming. Evidence clearly shows that during last two decades farming has become non-profitable and large number of farmers are doing farming because of compulsion not because of choice. Most of the farmers are not willing. Hence, it is necessary that farmers must receive remunerative prices of their produce and cost of inputs is reduced to make agriculture remunerative. Increasing number of farmers' deaths in India is a plain example of deteriorating condition of few sections of farmers. A large

number of farmers are not willing to remain in farming. Retaining them in farming is a major challenge before the country. The major reasons for dislike of farmers to be in farming occupation are lack of profitability, highly risky, and lack of social status (Singh R.P, 2006).

The present production structure in rural areas is mainly traditional and farmers produce the agricultural products without keeping in mind the consumers demand and raw products without grading and standardizing. If one want to reduce the poverty in India and uplift socio-economic condition of our farmers, it is imperative that their farm produce is properly graded and branded. Today, we need to produce world class packaged agricultural products, as consumers in India as well as across the globe have become quality and brand conscious. Thus, as markets are becoming global, the players increasingly require a global strategy. In fact, branding has become an essential element of business strategy in today's modern world and farming is no exception.

4. Agricultural Produce and Branding

Branding does not work in isolation, and is not just related to the development of a name, logo, company terms or combination of all three. The additional ingredient that makes a brand successful is differentiation or its personality. Successful brands tend to have strong "personalities" that appeal either to the rational or the emotional instincts of stakeholders. Successful brands appeal on an intangible level and offer a range of defined repeatable emotions to the consumer. Commodities by definition are not brands and offer no such emotional security or intangible benefits. Branding needs to extend beyond the basic product. However, farmers, corporate sector and all related agencies with marketing of farm produce have recognized the fact that the future economic prosperity demands a paradigm shift from offering commodity in simple form to differentiated goods and services to the consumers. One of the fundamental methods of differentiation involves branding of the produce. Though, today host of agricultural products are being branded in India, there exists a tremendous potential to exploit the situation for the benefit and upliftment of our farmers. Commodities deal solely in the product.

Presently, agricultural producers face the increased challenge of how to differentiate their offerings, so that their product is perceived and awarded premium status and price in their consumers' minds. Hence, it is important to implement a concentrated strategy that focuses on creating real value for those customers who are prepared to pay for it and a brand strategy based on product differentiation With the opening up of world markets and the possible reduction of subsidies in the western world, India could well emerge as the food factory of the world. We have therefore to look at the world markets and examine what they demand by offering them branded agricultural products.

5. Branding Issues - A Review

There are some major issues that need to be discussed before we go for branding of agricultural produce. For example, issues related to - the opportunity in terms of size, trend, and geography; the technology, scale, and commercial expertise which can be provided to the party; the sustainable value proposition in consumer terms; our business model for generating demand, ensuring supply, and managing customer relationships; the time period required to balance growth with profitability; and the right number people required to build a foods business. It must be noted that strong/superior - brand provides standardized products and distinctive identity to the products of farmers; branded products can be easily sold faster in the market; brand provides higher level of profits; brands live longer than the men, material and machine; brands ease the way for more products to be speedily adopted from the same house; and In fact, building brands is all about making products widely acceptable to the consumers.

Every enterprise wants to stay ahead of competition in the market and strive to retain distinctiveness and quality in their products and services so that a discerning customer is repeatedly drawn to them in preference to the competitors. The small and medium sized businesses get most hard hit, as they do not necessarily have adequate resources and infrastructure to deal with such exigencies. Significant effort and investments are made by businesses all around the world to establish a distinctive platform to enable consumers to identify the origin of a product / service (Prabuddha Ganguli, 2003).

A brand generally conveys to the consumer certain perceptions, attitudes and behaviors with which the consumers consciously and/or subconsciously feels comfortable to associate (Singh J.D, 2005). TATA in India is a well-known corporate house with a group of companies with a range of products varying from cars, trucks, buses, financial services, steel, and consultancy and so on. Though the corporate brand TATA (also a trademark) is the umbrella brand, the products have also been trademarked to retain her distinctiveness. Branding is not simply an afterthought, an add-on. The brand lies at the very heart of the organization and determines corporate actions. Therefore, we need to understand and communicate, internally and externally, the essence of its brand. The most successful brands are those that focus not solely on the tangible value but also the intangible value perceived by the customer.

The rewards for embracing and developing a strong, successful brand are high - and not just for the brand owner but for all stakeholders. The price of failure is commoditization and price wars that ironically fail to serve the interests of either buyer or seller. International fast food brands are having big plans of entering India which can be a big opportunity for Indian farmers. Fast-food retail chains such as KFC, McDonald's, Domino's, Pizza Hut and others are re-learning marketing lessons and segmenting their product portfolio to capture Indian

consumers across diverse income levels and lifestyles. The strategy is an attempt by some top retailers to tone up profit margins with a multilayered product portfolio that addresses the aspiration and needs of consumers willing to splurge while meeting the basic requirement at the bottom-end. With cut-throat competition to set up standalone outlets at busy marketplaces getting tougher, fast-food chains have come up with a new recipe for success - takeover and manage canteens across schools, colleges and corporate offices. With global supermarket majors such as Wal-Mart, Tesco, SPAR, Carrefour, Lidl, Aldi, 7-Eleven and others - already entered/planning to enter India and will be increasingly sourcing of processed foods from our country; it makes more sense for local companies and entrepreneurs to enter/expand in this arena.

However, there are many instances when the plans of many MNC companies come unstuck. The answer usually given is: “India is different”. Not many realize that the same can be said of Venezuela or Liechtenstein. Serious inquiry begins only when we ask how Indian consumers are different. There is one basic difference between the Indian and say, the American market: the urban-rural divide. The rural Indian consumer is economically, socially and psycho graphically very different from their urban counterpart (Moorthi, 2002**).** One has to guard against trademarks becoming generic and leading to dilution of exclusivity through common usage by the public or people in trade. Many original companies that own the trademark often lose out because of these generalizations. Also, Intellectual Property Rights (IPR) violations must be guarded (Martin Crutsinger, 2007).

6. Brand Management

Brand management is a dynamic exercise and therefore requires the enterprise to be adaptable to change as the market place experiences impact of technological development leading to newer innovations, changes in consumer tastes and product concepts, shifts in the economy, industry and brands. In India, agriculture is becoming a business and requires good branding of agricultural products to be acceptable by the consumers across the globe and can enhance the income of the farmers. Several Micro, Small, and Medium Enterprises (MSMEs) and cooperatives have recently been able to create brands of their products and services. However, certification of products is very necessary as it can satisfy prescribed standards concerning origin, material, mode of manufacture, quality, accuracy and other characteristics. For example in India, “Agmark” is a certification mark used for food items including spices, milk products etc. For example “LIJJAT Papad” conveys a brand for a cooperative of empowered women manufacturing affordable and preservable foodstuff for daily use. There are many agricultural products, which are regional and very much depends upon faith, omnipresence, goodness, purity, and icons. Sometimes, brand erosion takes place mainly

because of Arrogance when we can forget the customers, frequently re-launches and up-grade the brands; Greed of price-value equation; Complacency to ignore the competition; Inconsistency and Myopia. Brand must stand reflected in the entire business proposition - employees, government, vendor and stakeholders should not ignore to anticipate /recognize emerging market changes (Niall, 2001). Besides, there are several other factors that kill the Brand. Some of these are - pressure to compete on price; short-term/quarter-end half-baked targets; product quality in conflict with sales targets; complacency; failure to constantly upgrade brand image; and unable to sustain competitive edge.

7. Branding Strategies at Various Level

Branding is important for the marketing of commodities, fruits, vegetables and medicinal plants from India. The concept of agricultural produce branding comes from the dual retail notions that people attach certain qualities to branded products, and that consumers will pay a premium for high quality. When it comes to food, quality includes obvious traits like taste and healthfulness. For agricultural products, at the macro level, branding can be done at two levels, first is at the country level where a nation is promoted as a "brand" and the second can be at the state level, where a state or region is promoted as a brand particularly in the Indian context. At the micro level, branding can be at firm/consortium/NGO level. In this category, branding is done in such a way, that the entire category is promoted by a consortium of producers to jointly reap the benefits of branding. Such products are generally produced by a vast number of producers and their product is jointly marketed by a central processing authority (e.g. milk, eggs etc.). Also, it can be done at the corporate/company/NGO or individual level where an organization aims to gain market share by branding and differentiating factor (e.g. ITC's Atta, Shagun Chini and so on). It is clear, based on the context that India needs to develop various strategies to move up the value chain from commodities to branded agri-products.

7.1 National Level Branding

As the country is known for its software services, it needs to make efforts to become world's destination for sourcing of agricultural produce. A branding exercise helps a nation to establish a favorable image in relation to its agricultural produce that it has established in the global consumers' mind over a period of time. The commodity is often promoted on the basis of strong origin base, geographically. For example, Indian basmati rice, Malaysian palm oil, Brazilian coffee and so on. In such cases, nation itself becomes a brand ambassador for an agricultural commodity. However, branding of "India" alone cannot bring the desired results of improving farmers' income. It requires lot of efforts and initiatives from the Indian

government to improve the infrastructure and supply chain management. Some innovative initiatives measures like giving tax holiday for developing cold chain infrastructure can give a big boost in supply chain management. Some initiatives like exemption of Income tax for 5 years and exemption of 25% of profits for the next 5 years are steps in the right direction.

All these measures for setting up of new agro processing industries to process, preserve and package fruits and vegetables, and the like are positive developments for the Indian farmers. Relief in the customs and excise duties as well. Agriculture sector, instead of concentrating only on supply side strategy, the time has come to change this to demand driven strategy, so that our produce find markets and thus remunerative prices are available to farmers. We need to implement new farming techniques which can increase the productivity of our farms and improve the plight of Indian farmers. As a country, we should move towards organic farming which would fetch higher returns for our agricultural products in the global market. If we are able to bring India on the global map as a target hub for agricultural produce, it will be the biggest achievement, considering the benefits it will give to the millions of our Indian farmers. At every level, competition is increasing, and branding along with innovative packaging are increasingly the tools with which contests for consumers are won and lost. To get global acceptance, the country must face this reality and thereby ensure that our agricultural commodity are sold as brands.

7.2 State Level Branding

State level branding helps in identification of the produce at state level and it also helps in reducing marketing costs and a better distribution mechanism. This can be seen against a scenario where lots of efforts are required to market several smaller brands from the same region to different areas. For example, “apples” from Himachal Pradesh, it is the dominant fruit crop and accounts for about 45 percent of the total area under fruit crops and 88 percent of the total fruit production in the state. Thus, the state has inherent advantage in terms of favorable agro climatic conditions and existing brand name in the context of its “apple”. It is easy for a state like Himachal Pradesh to sell apples, emphasizing the fact that apples are of Himachal Pradesh origin. Same can be said for “Assam tea” or “Karnataka coffee”. Thus, state origin gives a unique advantage for an agricultural product compared to other regions in a same country.

Branding also helps in giving a sense of “identity” to the growers or producers of that region. This in turn leads to better farming and quality techniques before the marketing of the produce itself. For example, “Amul” is a classic example, where the owners take pride in their involvement in the milk revolution (state level)/white revolution (nation level).

Role of states in branding is an evident one. For example, in USA, one of its states South

Dakota under its Certified beef program, a calf's pedigree is traceable from birth to table because it has been fitted with an electronic identification tag, complete with a 13 to 15 digit number that allows the state to record every step of the animal's life, from its place of birth to the slaughterhouse. As a cow moves through growth and processing stages, premises numbers are added, recording each time the animal changes hands, such as when it's sold to a feed lot and finally a processor. Ultimately, it ends up in a store's meat display case waving its South Dakota Certified stamp of quality. This initiative is part of the state's long-term plan for tourism and economic development. In India, state government plays a very important role in agriculture, as this subject is in the state's domain. Thus, States would also have to look at ways and means to reduce costs, come forward to amend their respective Agricultural Produce Market Committee (APMC) Act, and take further facilitation measures in their domain. Some states have realized the potential of the agro business sector. Similarly, there is need to create agriculture hubs for our products on which we can derive competitive advantage.

Role of state government becomes all the more important as they can identify few agricultural products which can give higher yield because of a state's unique location or climatic advantage. This model has certainly to be extended beyond few explored commodities and we need to increase our product portfolio for agricultural produce from all the states of India. They have to be made successful brands. Thus, we need to create world class varieties and make them a brand in themselves. Thus, we can have success stories for Nagpur Oranges, Banana of Bhusawal, Litchi of Dehradun, Grapes of Nasik, Mangoes from Lucknow, Sugar from UP /Maharashtra, Cotton from Gujrat and Maharastra, Manipuri Black Rice, Darjeeling Tea, Saffron from Kashmir, and so on.

In fact, if we see the agricultural basket of Indian farm produce, the opportunities are endless. But the major bottleneck in increasing the income of farmers is the inefficient supply chain management. Lack of infrastructure, particularly in rural areas is a major issue. Farmers still have to face huge problems with regard to BSP (Bijli (electricity), Sadak (road), and Paani (water). India offers tremendous opportunities for the development of agriculture which is the ultimate solution for increasing the farmer's income. Development of infrastructure is a major challenge before our country. However, the silver lining is that many segments within the infrastructure sector are opening up for participation and private investments. From a state's perspective availability of good quality and state of the art physical and social infrastructure is one of the key determinants of its agricultural productivity and economic development. There is a wide gap that still exists between the potential demand for infrastructure for high growth in agriculture field and the available supply. Furthermore, to provide a boost to farm productivity at the state level, it would need to ensure an effective

telecommunication network, state of the art information technology infrastructure, uninterrupted supply of power and up gradation and modernization of existing rural area infrastructure.

7.3 Individual Level, Firm Level, and Corporate Level Branding

Branding at the firm/corporate level, is probably the easiest and most extensively of the branding methods available for the agricultural products. Some of the brands in India that are selling agricultural commodities/vegetables products are Safal Peas, Mother Dairy Milk, Annapurna Namak, Shagun Sugar, Annapurna Atta, Aashirwaad Atta, Parag Milk, Nestle Dahi (curd/yoghurt), Nestle Milk, Milma Milk, Milma Ghee, Milma Icecream and so on. Thus, there is lot of scope to sell branded vegetables, fruits, and commodities like rice, pulses, and the like. The decision of Spices Board of India, to promote spice cultivation by floating a company that will market branded spices under the favourite brand in an effort in right direction to ensure cooperatives and farmers that grow these spices get a good price for their produce (Ajayan, 2007). Also, there is a good international demand for certain fresh fruits as well as processed fruits products. Like mango, grapes, banana, litchi and exotic fruits like sapota, ber, pomegranate, custard apple, and the like have good export potential. Similarly, vegetables like onion, potato and green traditional vegetables like: okra, bitter gourd, green chillies can have a good acceptance in the global markets. Processed mushrooms and gherkins, and other like: asparagus, celery, bell pepper, sweet corn, green and lima beans and organically grown vegetables are also increasingly being exported.

At the corporate level, the company tries to transfer the brand associated with them to increase the credibility of the brand. For example, Tata Salt uses the name of Tata to generate credibility and trust associated with the brand and this is transferred to the product in a category where these qualities create a point of difference from other generic brands. Due to changing food habits, worldwide including India, there is a large potential of food processing industry which is a sunrise sector and could be a growth vehicle for uplifting the social and financial status of the farmers. This is corroborated by an extensive study carried out by the leading international consultants, Rabo Bank. In their Vision (2015) document prepared by them, they envisage trebling the size of the processed food sector so as to enhance farmer income, generate employment opportunities, provide choice to consumer at affordable prices, and contribute to overall national growth by increasing the level of processing of perishables from 6% to 20%, value addition from 20% to 35% and share in global food trade from about 1.6% to 3%.

The potential and growth is very evident from the efforts of companies like ITC, HLL, Godrej, Amul, Milma, Mother Dairy and the like. Branding can be an important tool by which

the corporate /cooperatives / NGOs / individuals can extend helping hand to the cause of farmers. Certain companies like ITC have gone many steps further besides branding and have engaged themselves in imparting a revolutionary dimension to its rural partnership by leveraging information technology to elevate the Indian farmer to a new order of empowerment. The 'e-choupal' initiative by it is a powerful illustration of the potential of information technology to transform rural economics, notwithstanding the structure and size of land holdings in India.

8. Strategies to Enhance Farmers Income

In a country like India where majority of the population lives in villages and is dependent on agriculture. Therefore, we must utilize and promote this inherent strength towards enhancing the global reach and thereby enhancing the income of our farmers. We should focus on developing branding as a national priority in the agricultural sector.

It should cover all the possible areas like agricultural commodities, dairy, fruits and vegetables, aromatic plants, herbs /spices / food / fruit processing units and its allied. According to a World Bank study, which is based on primary value chain surveys of 10 horticultural items, 1,400 farmers, 200 commission agents and 65 exporters across 17 Indian states, the report highlighted the fact that despite producing 11% of the world's vegetables and 15% of world's fruits at very competitive costs of about 53% and 63% of average global prices, India's share in global fruits and vegetables trade has remained at only 1.7% and 0.5%, respectively.

There are number of reasons attributed for this anomaly. These are - long and fragmented supply chain retail structure; inadequate infrastructure; including cold chain storage; transportation; special handling facilities at airports; inadequate post-harvest management; limited access to appropriate technology for processing and packaging; low investment in R&D by industry; and high cost of production. By the time a product like apples or potatoes ends up with the foreign consumer, its price will have gone up by nine to 10 times. However, the pity is that the farmer is not getting any benefit of these high prices. For example, let us the take an example of grapes - although the retail price in the US is Rs. 120.30, the farmer gets only Rs. 13.50, while the intermediaries claim Rs. 5.40, the exporter Rs. 24.20, and international freight and insurance claim about Rs. 53.50. The importer contributes the remaining Rs.23.50 to the total cost. Compared to 30-40% in the US or Thailand, the Indian farmer gets to keep only 15-20% of the final price. It will be an irony but it's true that it is cheaper for the state of Tamil Nadu to import apples from Australia than Himachal Pradesh. The cost variation between states can run up to 70%. With as many as six to eight intermediaries coming in the marketing chain, the average wastage between just the farm gate

and the wholesale level is around 12%, adding another 7-10% by the retail stage. Farmers' incomes in many grain production regions are declining. As a result, the income gap between urban and rural residents continues to widen.

Thus, agricultural restructuring and increasing farmers' incomes is very important agenda for the county. If farmers' incomes do not increase in future, farmers will lose interest in production. Slow improvement in the purchasing power of farmers will not only dampen the demand for all consumers and industrial products as most of our consumer goods companies like HLL, Dabur, ITC, Godrej and the like are dependent on rural demand. Thus, it is a very backbreaking task to resolve the problems of farmers' incomes. For increasing the income of farmers, it is imperative to increase spending on the agriculture sector and to improve the environment for the development of the rural economy. The most effective approach to reach the goal is to increase the overall efficiency of agriculture by restructuring the sector and rural economy, which is bound to create many new growth opportunities for our farmers. Therefore, strong measures should be taken - to improve grain quality and processing of agricultural products; to speed up the development of industrial and service sectors in the rural areas; and to promote the restructuring of rural enterprises. It is a big challenge. However, we need to remove some of our major weakness and need to take some corrective measures.

8.1 Major Weakness

- We can't compete globally as we have a large number of small farmers. Unless we consolidate within the country, it will be difficult for us to increase the yield. We need large scale, to be globally price competitive. Large scale of production gives lot of volume advantages in getting a right price for the produce.
- We have never invested in providing the right market information to our farmers. Farmers have been producing what they can produce, rather than producing, what the market demands. Hitherto, the seed quality has been poor leading to low yields. Now, we know that quality matters, earlier we thought only price mattered. To sell in the world market, we have to produce best quality agricultural commodities at attractive prices.
- We are just beginning to brand things, and it is a fact that brand does matter. Amul has shown us how a commodity like milk can be branded and sold in India. We need to focus and grow more and more “organic” products. Also, we need to produce as per the current trends and global demand. For example although USA has allowed of India mangoes on its soil in 2007, but we should not forget that it had earlier banned mango imports from India for almost 18 years on the concerns that Indian farmers used too

many pesticides. Even now, we should not feel complacent as Indian farmers will have to irradiate the fruit to kill any pests, making the mangoes fit for consumption not only in the eyes of U.S. agriculture officials but in other countries too.

8.2 Strategies

- Realize the importance of branding for the agricultural products. A move from selling agricultural commodity to selling "agricultural branded product" will go a long way in helping our farmers to improve their incomes. A combined initiative at the national level by the Central government, State level by the state governments and at firm level by the corporate, and NGO's is required. It is also to be noted that industries/policymakers promoting brand for agricultural produce must look everything from the farmers (Yield/goals) viewpoint and also do customer mind mapping. Customers may look alike but soil conditions are different. Thus, different strategies are required for different level (income/crop differentiation) of farmers and for different set of consumers.
- In terms of branding, we must realize that all the efforts of our central government, state governments, self-help groups / cooperatives, NGO's, FPOs, corporate dealing in agriculture sectors as a whole - contribute towards the building of a global image for the country. We must ensure that consistent messages reach target groups from word-of-mouth recommendations to official branding events in India and abroad, exhibitions and trade shows in India and abroad. Indian embassies across the globe can make an important role in promoting our agricultural produce. We must take every opportunity to build agricultural global brands, which will in turn complement efforts to build a strong and respected international image for our country.
- Indian farmers need to be supported and empowered to capture optimum value for their produce by linking them more effectively with consumers in the domestic and international markets. At the micro level, it is always better to have conduct a Brand Environment Audit by surveying what sells, and what doesn't, and why? It is necessary to examine the issues related to brand as well as unbranded local produce that sell and examine how the agricultural products are purchased by the consumers /end users. Focus on customer expectations and then determine one's brand destination.
- The country must move towards producing agricultural produce that can fetch higher returns. For a comparison if we take example of our neighboring country China, the average yield per hectare of rice in China is about twice that in India, while in the case of wheat it is one and a half times higher. Thus, increase in productivity would enable

higher farm income and concurrently reduce cost of calorific intake for the poor.

- Diversification of land use to optimize farmer income by better aligning produce with needs of the market, both domestic and international. We must produce domestic surplus in the agriculture sector which is exportable and acceptable in the world market.
- Put investment in post-harvest infrastructure in our country. With the entry of big retail giants, the future growth will be led by their symbols of modern retail trade. With the advent of modern trade, it is estimated that organized retailing would reduce costs and provide gains to consumers as well as to farmers.
- Initiatives on individual crop insurance for farmers; minimum support price; overcome vagaries of nature; and access to state agricultural universities for information and training can help the farmers' to improve their income. Beside, to achieve optimum efficiency, farmers need - better seeds; better farming practices; and better cropping systems. The scientific community should come forward for the help and guidance of farmers for the fast forward movement and development of the sector.
- Use of Information and Communication Technology (ICT) can be used - to alleviate the farmers from poverty and enhance their income; to aggregate demand in the nature of a virtual producers' cooperative; to access higher quality farm inputs and knowledge at lower cost; to set up a direct marketing channel virtually linked to the mandi system for the purpose of price discovery; to eliminate wasteful intermediation and multiple handling; to reduce transaction costs and making logistics efficient; to coordinate services related to credit, insurance, health, education, and entertainment; and to serve as a strong foundation for creating a vibrant futures market to facilitate farmer risk management.
- Easy credit at low rates is essential for the farmers. The favourable decision of Reserve Bank of India to exempt farmers from submitting "no due" certificate (NDC) for obtaining loans from banks for certain extent is a step in right direction (Koshy, 2007).
- Use of Engineering Technology is of utmost important in the area of farming and food processing. Government should give suitable concessions, if some technology is being imported into the country which has the potential to improve quality and economies of scale.
- Effective linkages with the food processing industry to develop and market value added products in the domestic and international markets.
- Developing modern food parks that have facilities for sorting and grading of agriculture produce for export is required for having a competitive edge for our farm

produce. The prices of commodities should not be open for speculation and hoardings in the commodity exchanges.

- Higher price realization should also be a key factor while considering the farming options. One such opportunity is in cultivating medicinal and aromatic plants. These can then be promoted by securing appropriate linkages between the research institutions, farmer cooperatives and private enterprises engaged in the use of such products.
- Although many cooperatives are already active in agricultural sector, involving MNC's, big corporate houses, promoting rural retail, and contract on large scales, can also bring desired result of boosting rural economy which will ultimately benefit the farmers residing in rural areas.
- Persuade the farmers directly involved in the farming that they benefit, directly or indirectly, from increased marketing and branding efforts, be they at the national or at the individual enterprise level. The additional cost and extra effort in pursuing branding strategies is more than made up by the additional returns derived from implementing these strategies.
- The concept of Fair Trade Certification - which aims to establish direct trade for farmers in developing countries and to ensure that they receive fair prices for their agricultural products and to develop the business capacity necessary to compete in the global marketplace.
- Help of international organizations /agencies can be taken, who can bring their global experience for farmers' benefit. In order to bring farmers and retailers together on a common platform using ICT that will help farmers improve their productivity and supply produce as per the retailers' demands. A model consists of a complete supply-chain management system that will electronically link all elements, starting with retailers through transporters, farmers, input suppliers, and other supply chain participants. This will enable the farmers' cooperative to play the part of an effective intermediary serving the fresh produce needs of the organized retail industry and will create a successful model for others to replicate

9. Conclusion

Branding of commodities will offer additional value both to the consumers and the producers. Branding will lead to commodity differentiation and hence enable consumer preference. India needs creative solutions to start a revolution which can take its farmers fast forward in time - creating them economically viable; and growth drivers of our economy. A mechanism has to be developed for harnessing the power of our farmers and opening up new

horizons for all in the country, with promise of a better tomorrow. For that, we have to give more importance to the aims and objectives of sustainable development agenda goals (SDGs) to - 'end poverty in all its forms everywhere' (SDG 1); 'end hunger, achieve food security and improved nutrition, and promote sustainable agriculture' (SDG 2); 'ensure healthy lives and promote well being for all of all age groups' (SDG 3); 'build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation' (SDG 9); which can help us further to 'reduce inequality within and among countries' (SDG 10); 'ensure sustainable consumption and production patterns' (SDG 12); and finally these could help us to attain the remaining SDGs and 'partnerships for the goals' through branding of agricultural produce and enhancing farmers income - to strengthen the means of implementation and revitalize the global partnership for sustainable development by supporting for SDG 17.

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(Ⅱ) In this sample, the following equations are presented as illustration.

$$\int_0^{r_2} F(r,\varphi)\, dr\, d\varphi = [\sigma r_2 / (2\mu_0)] \qquad (1)$$

where t = 0, . . . , T, and b is a number greater than 1.

It should be noted that all easily confused characters and symbols, upper and lower case letters, as well as block and italicized lettering should be noticed to the proceedings editor

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Again, we really appreciate your participation and contribution and hope to see you in France in 2022!

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