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The Complexities of Agricultural Transformation System Emulation Within Pacific Island Countries and Territories; and Its role in Economic Development

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Abstract - Agriculture globally has seen a lot of system transformation and innovation which has also affected food production. The nations with access to the core drivers behind the transformation have benefited from technological development through access to the tools, resources, and systems that have brought about the development. However, some regions and countries with resource constraints or are comparatively behind in taking advantage of technological progress and advancement, have been lagging in emulating the expected and supposed economic value that could have been generated.

Keywords — agricultural systems, emulation, PICT, traditional knowledge, transformation

I. INTRODUCTION

The agricultural sector traditionally is a vital segment of any economy as it provides food, shelter, and clothing to support the human capital that serves as the input into the production of goods and services. For most less developed countries, there is less development within their industrial sector which leads them to heavily rely on agriculture. When an economy is agriculture reliant, comparatively higher effort and resources are allocated towards crop cultivation, livestock rearing, and fish for economic and subsistence. Agriculture thus has natural, social, human, physical, and financial capital impacts on the economy. The records available suggest that a common feature of economies that are heavily reliant on agriculture is poverty, slow or limited industrial sector, technological development, and innovation. All the top-ten countries most dependent on agriculture by their contribution to their GDP are low-income countries with limited technologically embedded agricultural sectors. Namely, Liberia(76.9), Somalia(60.2), Guinea-Bissau(55.8), Central African Republic(53.1), Chad(52.7), Comoros(51.6), Sierra Leone(51.5), Togo(46), Ethiopia(41) and Niger(39), (World Atlas 2022).

It is worth noting that throughout history, famines have occurred in nations that specialize and focus on agriculture but without technologically advanced and enabled agricultural systems whilst other countries that do not focus on agriculture but have focused on the industrial revolution which also influences their agricultural sectors rarely have suffered famines. The trends and history tend to suggest that in order for Pacific Island Countries and Territories(PICT) and any country that desires to have the same level of developmental progress that has been experienced by the currently developed and industrialized nations will have to emulate what those who have actually developed did. All developing countries have focused on agriculture. Rich countries focus on and develop their industries, technological research, and innovation even within agriculture which provides efficiency gains to their economies(Reinert 2008). Waste is reduced whilst agricultural yields are maximized from the new systems, strategies, agrochemicals, and technological aids that can be included in the agricultural process within the economy. However, the constraints of the limited resources on the factors of production which is faced by some economies appear to slow down the efficiencies and gains that they realize. With this lag in emulation of technological and industrial progress, the agricultural activities that are practiced in the more developed economies and could be practiced globally do not get into the hands of some economies. Such countries are therefore left with the option of engaging traditional small-scale farming and underdeveloped or limited modern technologically enabled agricultural systems which generally leads to limited economic significance in global markets.

Although there are a number of prior works on the importance of agricultural transformation, soil pollution(Rodríguez-Eugenio, McLaughlin, and Pennock 2018), farming systems(FAO 2018), its benefits, and the form of the technological advancements(Bachewe et al 2018) to date. Much of the academic literature has been done and centered around the more developed economies and the bigger economies due to the funding constraints. As such other areas

with specific respect to PICTs are yet to be explored. This research aims to contribute to the existing and prior work in this area.

II. THE COMPLEXITIES IN EMULATING AGRICULTURAL SYSTEMS TRANSFORMATION IN PICT

There are 21 tropical and subtropical Pacific Island Countries and Territories (PICT) and these include; American Samoa, Cook Islands, Federated States of Micronesia, Fiji, French Polynesia, Guam, Kiribati, Marshall Islands, Nauru, New Caledonia, Niue, Northern Mariana Islands, Palau, Papua New Guinea, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu, Vanuatu, and Wallis and Futuna(Yemoh and Yemoh 2022). The main economic earnings in the PICT come from agricultural produce, fishery, agriculture, agriculture-related enterprises and tourism, and trade, amidst cash crop production, small-scale commercial production, and subsistence cultivation. Vanuatu, Papua New Guinea, and the Solomon Islands do have significant mineral resources. Papua New Guinea has an industrial zone, and Fiji has cash crops in sugar which has permitted the country to expand into a more diversified economy whilst in the rest of the developing islands, semi-subsistence agriculture is practiced and provides a material percent of national exports. The export trade in the Pacific island countries is dominated by agriculture and national resource-based harvests from the ocean and forest such as cash crop agricultural commodities that require labour-intensive processing, such as palm oil, copra, coconut oil, vanilla, coffee, and cocoa (FAO 2022).

A recent UN 2022 report found that global prosperity is being reversed. Agriculture, which is and has been one of the keys to food security, lasting peace, and prosperity also changed in the last five years with a spike in global levels of acute hunger(UN 2022). A global food crisis, already impacted by the COVID-19 pandemic and climate change, is being driven to famine levels worldwide. Around the world, 44 million people in 38 countries are at emergency levels of hunger. All of these are the drivers behind the need for all economies including PICT to look into better ways of increasing the agricultural yields with regard to technological research, development, transformation, and innovation that would help provide a sustainable food and agriculture supply.

Evidence from the most recent two decades of change in agricultural systems in the face of the complexity of problems suggests that it takes multiple change strategies, significant transformation, radical change, or a transition towards sustainability to effectively implement desirable food and agricultural systems(Dentoni, Waddell and Waddock 2017). Global food production and agriculture saw sharp increases in the mid-20th Century through the heavy use of fertilizers, herbicides, and pesticides which may have affected the environment negatively or led to direct harm to health(Abeywardana et al 2019). Agriculture has traditionally been linked to food production. New crop varieties and livestock breeds, combined with increased use of inorganic fertilizers, pesticides, and machinery, together with better water control, led to sharp increases in food production from agricultural systems(Pretty and Bharucha 2014).

All things being equal, there are four broad constraints to agricultural productivity and sustainability: water, soil, biodiversity, and land(Pretty and Bharucha 2014). The produce that an economy produces, therefore, depends on its ability to engage all resources including technology in a way that helps them to overcome or limit the impact of the constraints on its agricultural processes. Being able to innovate and implement or emulate the proven agricultural systems of other economies allows economies to transform their agricultural sector. Transformation in Agriculture is therefore the changes effected within an agri-food system over time from subsistence and farm-centered into a commercialized, productive, and off-farm-centered one (Jayne et al, 2019). The stages through which agricultural systems undergo transformation are known to be first, a Traditional Agriculture and then the engaging of technologically dynamics Agriculture or low capital technology and finally technologically dynamic Agriculture or a high Capital Technology(Mellor 2017).

Technological advancement and the discovery in technology and interconnectivity of the world nations have not only affected international trade and development but have been embraced by many of the economies that can afford the cost of implementing the new advances or have been fortunate enough to invest in the research that discovers the development and advances. Sophisticated technologies such as robots, temperature and moisture sensors, aerial images, and GPS technology are routinely used nowadays to improve the yields whilst accelerating the impact of the resources used as inputs in agriculture. Others include agricultural drones, IoT-based sensor networks, Phase tracking, Weather forecasting, Automated irrigation, light and heat control, Intelligent software analysis for pest and disease prediction, soil management, and other involved analytical tasks. Genetically Modified Crops, Merging Datasets, Vertical farming, hydroponic farming, and aeroponic farming are all growing practices employed in various economies that utilize the modern greenhouse. These are yet to be widely adapted within PICT and therefore the benefits to the economic development and fruits are yet to show.

These advanced devices and precision agriculture and robotic systems have allowed agricultural businesses to be more profitable, efficient, safer, and more environmentally friendly. In the absence of such devices in PICT, all the agricultural processes, systems, and strategies employed will

be contributing much less to the economies. The ease at which such technology and modernized systems, processes, and strategies are embedded into an economy depends heavily on economic development. The more developed an economy, the more they are invested in such developmental projects and will also have the means to procure the resources and materials necessary. Consequently, those countries that fall into such a bracket will therefore realize the benefits of agricultural technology. For example, Some nations have enlisted modern technology to have water-efficient irrigation systems that allow farmers to reduce waste and only apply water, and agrochemicals uniformly across entire fields. The great benefit from this is higher crop productivity, a reduction in the wastage of water, fertilizer, and pesticides, with the economic value of keeping food prices down. Other benefits of the technology in agriculture are a reduced impact on natural ecosystems, and less run-off of chemicals into rivers and groundwater, Increased worker safety. Robotic technologies are engaged in Agriculture to enable efficient monitoring and management of natural resources, such as air and water quality. They are also used heavily in environments that require a certain atmosphere, weather pattern, weather condition, a certain amount of water, alkalinity, etc. Robotic technology also gives producers greater control over plant and animal production, processing, distribution, and storage, which results in greater efficiencies and lower prices, safer growing conditions and safer foods, and reduced environmental and ecological impact.

In order to emulate any of the current and modern technology, systems, and improvements being used in developed economies, the proper means to recognize what is lacking, in addition to the means and quality to appropriately implement it into the economy is required. This is what is lacking in most PICT as a majority of the economies are not as developed as others and not at the level of advancing research in a way that facilitates aggregate national technological discoveries which will benefit the PICT. Much of the PICT still engages largely in indigenous Agriculture. These indigenous systems engaged and practiced in PICT have undergone some technological, management, and socio-cultural changes to date, however, their sustainability is vulnerable to rapid changes due to modernization, market changes, education levels, and inconsistent management decisions(Abeywardana et al 2019). Behind the successful technological advancement in agriculture is quality research and development in physical sciences, engineering, and computer sciences. Also, the development of agricultural devices, sensors, and systems, Applied research that assesses how to employ technologies economically and with minimal disruption to existing practices and effectively equips people on how to use new technologies. The core determinant behind all of these advancing technology in agriculture is the capability and resources.

V. CONCLUSIONS

Advances in technology and machinery employed in agriculture have expanded the speed, scale, and productivity of farm equipment, leading to more efficient cultivation of more land. Seed, irrigation, and fertilizers also have vastly improved, helping farmers increase yields. Increasing control over agriculture processes, systems and thus production leads to better cost management and waste reduction. The ability to trace anomalies in crop growth or livestock health, for instance, helps eliminate the risk of losing yields. Additionally, automation boosts efficiency. Agricultural technological advancement including Robotics and artificial intelligence in the long run makes aggregated economic sense and depends on the clear-eyed economic decision-making by the governments in PICT. Although the world is rapidly discovering and implementing great technological advanced systems, strategies, and modern tools, PICT ability to emulate these and realize the benefits are lagging emulation due to the resource constraints. This is especially pertinent due to the food security concerns amongst PICT. Due to the resource and investment constraints in PICT, much of the investments that are going into these agricultural systems are for small-scale transformation instead of material agricultural systems copying and transformations which can be credited for the agricultural developments and economic advancements of the developed countries. With the limited scale of investment into innovation, research, and development, the progress and discoveries in PICT in Agriculture are also constrained, and therefore development through agriculture is also limited. The ability to emulate what is also being practised in other leading agriculture based economies like the PICT is also limited.

REFERENCES

[1] Clausen, J., Barrantes, N., 2022, Developing a Comprehensive Multidimensional Wellbeing Index Based on What People Value: An Application to a Middle-Income Country. Applied Research Quality Life . https://doi.org/10.1007/s11482-022-10064-w).

[2] Abeywardana, N., Schütt, B., Wagalawatta, T., & Bebermeier, W. (2019). Indigenous Agricultural Systems in the Dry Zone of Sri Lanka: Management Transformation Assessment and Sustainability. Sustainability, 11(3), 910. https://doi.org/10.3390/su11030910

[3] Bachewe, F. N., Berhane, G., Minten, B., & Taffesse, A. S. (2018). Agricultural transformation in Africa? Assessing the evidence in Ethiopia. World Development, 105, 286-298.

[4] Bonnell Courtney 2022, Zimbabweans count their toes as inflation soars above 130%, The Associated Press, https://uk.yahoo.com/news/zimbabweans-count-toes-inflation-soars-081706675.html, accessed 11 June 2022

[5] Dentoni Domenico, Waddell Steve, and Waddock Sandra, 2017, Pathways of transformation in global food and agricultural systems: implications from a large systems change theory perspective, Current Opinion in Environmental Sustainability, Volume 29, Pages 8-13, ISSN 1877-3435, https://doi.org/10.1016/j.cosust.2017.10.003.

[6] Erik S. Reinert, 2008, How Rich Countries Got Rich, and Why Poor Countries Stay Poor, Publisher : PublicAffairs (October 7, 2008), ISBN-10 : 1586486683, ISBN-13 : 978-1586486686

[7] FAO, F. (2018). Food and agriculture organization of the United Nations. Rome, URL: http://faostat. fao. org.

[8] Felipe J, Kumar U, and Arnelyn A, 2010, How Rich Countries Became Rich and Why Poor Countries Remain Poor: It's the Economic Structure . . . Duh!*, Asian Development Bank, Manila, Philippines December 2010, Levy Economics Institute, https://www.levyinstitute.org/pubs/wp_644.pdf, accessed 10 June 2022,

[9] Jayne, T.S., Benfica, R., Yeboah, F.K. and Chamberlin, J. (2019), "Agricultural Transformation and Africa's Economic Development", Nnadozie, E. and Jerome, A. (Ed.) African Economic Development, Emerald Publishing Limited, Bingley, pp. 349-375. https://doi.org/10.1108/978-1-78743-783-820192018

[10] Mellor John. W., (2017). Agricultural Development and Economic Transformation; Promoting Growth with Poverty Reduction. Palgrave Studies in Agricultural Economics and Food Policy.

[11] Pretty Jules, and Bharucha Zareen Pervez, 2014, Sustainable intensification in agricultural systems, Annals of Botany, Volume 114, Issue 8, Pages 1571–1596, https://doi.org/10.1093/aob/mcu205

[12] Rodríguez-Eugenio, N., McLaughlin, M., & Pennock, D. (2018). Soil pollution: a hidden reality. FAO.

[13] UN 2022, Lack of Grain Exports Driving Global Hunger to Famine Levels, as War in Ukraine Continues, Speakers Warn Security Council, Meetings Coverage and Press Releases, SC/14894, 19 MAY 2022, https://www.un.org/press/en/2022/sc14894.doc.htm accessed 10 June 2022,

[14] Yemoh Vicky and Yemoh Michael, 2022, COVID-19 Vaccination and Border Restrictions; Evaluation and Outlook on Health and Socio-economic Systems in Pacific Island Countries and Territories, International Journal of Scientific Research and Engineering Development-– Volume 5 Issue 1, Jan-Feb 2022

[15] World Atlas 2022, Countries Most Dependent On Agriculture, https://www.worldatlas.com/articles/countries-most-dependent-on-agriculture.html, accessed 28 June 2022