Agri-Food Policy Transition and Expectations for Emerging Technologies: Implications from Socio-Technical Regimes

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1. Introduction

As the world is undergoing a major shift in its current situation, including climate change, food security concerns, and technological change, agricultural policies are seeking ways to respond to these trends. The "Green Food System Strategy" (MeaDRI strategy) was proposed by the Japanese Ministry of Agriculture, Forestry and Fisheries (MAFF) in 2021 within this kind of policy context, and tries to incorporate various technological elements, including smart agriculture.

In this paper, I review the trends of technological development in the food and agriculture sector, including the MeaDRI Strategy and other countries' strategies, and discuss what kind of innovation is needed to promote transitions toward a decarbonized society. In the course of this discussion, I will try to uncover implications of various approaches such as sociology of expectations and sociotechnical regime theory. In doing so, I will pay particular attention to the multifaceted development of innovations, and clarify the issues that need to be considered in policy responses to solve problems arising from future challenges.

2. Innovation Strategies Compared: Japan, the EU, and the US

1) MeaDRI Strategy (Japan)

In May 2021, the Japanese MAFF released the "Green Food System Strategy: Achieving both productivity improvement and sustainability of food, agriculture, forestry, and fisheries through innovation" (MeaDRI Strategy). As the subtitle of the strategy clearly indicates, it is intended to solve the somehow conflicting goals of improving productivity and sustainability through innovation. Among the specific initiatives listed in the strategy are a number of new technologies (e.g., drones, AI, super varieties, food tech) that have been attracting attention in recent years.

2) Farm to Fork Strategy (EU)

In May 2020, the European Commission published "A Farm to Fork Strategy: for a fair, healthy and environmentally-friendly food system". It was developed by the European Commission for a sustainable food system under the European Green Deal (EGD), which was proposed as a new growth strategy in the face of climate change. It describes a just transition to a food system that is desirable for consumers, producers, the climate and the environment. Although innovation is also emphasized, the emphasis is on discussing the key frameworks that will drive research and development rather than specifically discussing individual technologies.

3) Agricultural Innovation Strategy (US)

In the United States, the USDA released its "Agricultural Innovation Strategy" in January 2021, with the goals of increasing agricultural productivity by 40% and halving the environmental footprint by 2050. The strategy is unique in that it identifies four key innovation clusters ((a) genome design, (b) digital and automation, (c) prescriptive intervention, and (d) system-based farm management) and focuses on how to utilize these technologies.

4) Comparison Among Strategies

Japan's strategy sets a somewhat limited policy goal (compared to the EU) of addressing climate change, such as increasing productivity and greening policies. It is then characterized by a commitment to deploy the widest possible range of technological solutions, while taking into account the current state of domestic agriculture and public understanding of the issue. In contrast, references to specific technologies are limited in the EU. Both Japan and the US share a strong orientation toward the adoption of new technologies, as both are formulated by the administrative offices related to agriculture.

It might be useful to visually contrast the main keywords

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that appear in the Japanese, European, and US strategies. Here, I use NVivo, a text analysis software, to create a "word cloud" to visually compare the frequently appearing words in each strategy (Figure 1).¹⁾ In comparing the word cloud, the words that appear frequently in each strategy can be depicted in the following way.

Japan: innovation, energy, biotechnology, system, data, pest.

EU: vision, sustainable, food, products, framework, proposal.

US: innovation, data, agriculture, tools, systems.

Again, the impression of Japan and the US is rather close, and the difference from the EU's F2F strategy is striking. This may be due to the characteristics of the technology-centered strategy document.



Figure 1. Word Cloud from the US Strategy

3. Innovation Strategies and Regime Change

What suggestions can be obtained when reviewing the innovation strategies from the perspective of the sociology of expectations (Borup *et al.* 2006, Yamaguchi and Fukushima, 2019) and socio-technical regime theory (Geels and Schot, 2007)? In the following, I will argue some issues, albeit limited in space.

Strategies officially announced by the government, including the current MeaDRI Strategy, provide a justification of expectations for each technological development. As a result, the technological developments listed in this strategy should gain momentum. The point to be noted here is how the existing socio-technical regimes will be strengthened or restructured in the course of mutual coordination among the various parties concerned with these

expectations. New technologies aiming at a decarbonized society can be understood as requiring a shift in sociotechnical regimes, and in this sense, how to achieve mutual coordination among a wide range of parties involved is an important point.

The following point can be suggested from the viewpoint of socio-technical regime theory. The formation of sociotechnical regimes (or more broadly, the desired conjuncture between such regimes and other sectoral regimes) is essential for technological innovation to take root, rather than simply technological elements. focusing on Transforming conventional agriculture into a socio-technical regime that can respond to decarbonization and climate change is an issue that should be considered in conjunction with the goal of expanding organic agriculture. However, the overall picture of what kind of technological regimes, including drastic reductions in chemical fertilizers and pesticides and labor-saving technologies, will be transformed into new regimes is not clear in the MeaDRI Strategy. Post-war experience in Japan suggests that the high level of mechanization of medium-sized rice farming could not be separated from the local labor market, road infrastructure, agricultural cooperatives, and pension system. The question is how the parties involved can mutually coordinate and form a new socio-technical regime under the expectations for the future that the MeaDRI Strategy envisions.

4. Conclusion

I have reviewed recent developments in agricultural technology and examined the contents and characteristics of innovation strategies for agriculture in Japan and other countries. Food issues are strategically important in global environmental issues. This is because, by working on food, we can work on various global issues simultaneously. For example, the EAT-Lancet report (Willett *et al.*, 2019) pointed out that food is the single most powerful instrument for optimizing human health and environmental sustainability on the planet. The time has come for the MAFF and those involved in agricultural policy to reaffirm the significance and importance that food has on a global scale.

NOTE: This research was supported in part by a JSPS Grant-in-Aid (19H00960 and 21H04745).

¹⁾ Due to space limitation, only the figure of US innovation strategy is shown here.

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