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THE IMPACT OF SUSTAINABILITY PRACTICES IN THE AGRICULTURAL INDUSTRY IN UZBEKISTAN

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Abstract: The study aimed to examine sustainable agricultural practices based on three pillars: economic, social, and environmental. Therefore, the study set research questions related to determining the current state of sustainable agriculture in Uzbekistan, how farmers adopt sustainable agricultural practices, and the challenges they face in these processes. The study utilized a qualitative methodology to collect and analyze data. Using the interview technique, qualitative data were collected from a sample of 6 agricultural farmers in Tashkent, Uzbekistan. The important findings of the study showed that farmers are well familiar with and recognize the principles of sustainable agriculture. The challenges faced by agricultural farmers today are soil degradation, water scarcity, and technology-related limitations. In terms of economic sustainability, farmers are more concerned about the financial health and profitability of farming by improving their output and productivity. While conscious of socially sustainable agriculture, two farmers are still using traditional methods to grow crops. The findings showed that not all the selected farmers are socially sustainable. While some of them adopted organic farming principles to make their farming more sustainable, there were some farmers who still use traditional farming methods that are unsustainable. Not all crop-farming agricultural enterprises took advantage of the efficient use of water resources. They used traditional irrigation systems that waste water resources due to evaporation and absorption into the soil before reaching the crops. Finally, livestock farmers did not use advanced practices and techniques to effectively manage their farms and reduce the risk of air pollution.

Keywords: sustainable agriculture, economic sustainability, social sustainability, environmental sustainability, Uzbekistan

Annotatsiya: Tadqiqot iqtisodiy, ijtimoiy va ekologik ustunlarga asoslangan barqaror qishloq xo‘jaligi amaliyotlarini o‘rganishga qaratildi. Shu sababli, tadqiqotda O‘zbekistonda barqaror qishloq xo‘jaligining hozirgi holatini aniqlash, fermerlarning barqaror qishloq xo‘jaligi amaliyotlarini qanday qabul qilgani hamda ushbu jarayonlarda duch kelgan muammolariga oid tadqiqot savollari qo‘yildi. Tadqiqotda ma’lumotlarni yig‘ish va tahlil qilish uchun sifat metodologiyasidan foydalanildi. Intervyu usuli yordamida sifat ma’lumotlari Toshkent, O‘zbekistondagi 6 nafar qishloq xo‘jaligi fermeridan iborat tanlanmadan to‘plandi. Tadqiqotning muhim natijalari shuni ko‘rsatdiki, fermerlar barqaror qishloq xo‘jaligi tamoyillari bilan yaxshi tanish va ularni tan oladilar. Hozirgi kunda qishloq xo‘jaligi fermerlari duch kelayotgan asosiy muammolar tuproq degradatsiyasi, suv tanqisligi va texnologiya bilan bog‘liq cheklovlardir. Iqtisodiy barqarorlik nuqtai nazaridan, fermerlar ishlab chiqarish hajmi va unumdorlikni oshirish orqali fermer xo‘jaligining moliyaviy holati va rentabelligiga ko‘proq e’tibor qaratadilar. Ijtimoiy barqaror qishloq xo‘jaligi haqida xabardor bo‘lishlariga qaramay, ikki nafar fermer hanuzgacha ekin yetishtirishda an’anaviy usullardan foydalanmoqda. Natijalar shuni ko‘rsatdiki, tanlangan barcha fermerlar ham ijtimoiy jihatdan barqaror emas. Ularning ayrimlari fermer xo‘jaligini yanada barqaror qilish uchun organik dehqonchilik tamoyillarini qabul qilgan bo‘lsa, boshqalari hali ham barqaror bo‘lmagan an’anaviy dehqonchilik usullaridan foydalanmoqda. Ekin yetishtiruvchi fermer xo‘jaliklarining barchasi ham suv resurslaridan samarali foydalanish imkoniyatidan to‘liq foydalanmagan. Ular suvning bug‘lanishi va ekinlarga yetib borishidan oldin tuproqqa singib ketishi sababli suv resurslarini isrof qiladigan an’anaviy sug‘orish tizimlaridan foydalanganlar. Nihoyat, chorvachilik fermerlari o‘z xo‘jaliklarini samarali boshqarish va havoning ifloslanish xavfini kamaytirish uchun ilg‘or amaliyot va texnologiyalardan foydalanmaganlar.

Kalit so‘zlar: barqaror qishloq xo‘jaligi, iqtisodiy barqarorlik, ijtimoiy barqarorlik, ekologik barqarorlik, O‘zbekiston

Аннотация: Исследование было направлено на изучение практик устойчивого сельского хозяйства, основанных на трёх компонентах: экономическом, социальном и экологическом. В связи с этим в исследовании были поставлены вопросы, связанные с определением текущего состояния устойчивого сельского хозяйства в Узбекистане, тем, как фермеры внедряют практики устойчивого сельского хозяйства, а также с трудностями, с которыми они сталкиваются в этих процессах. В исследовании использовалась качественная методология для сбора и анализа данных. С помощью метода интервью качественные данные были собраны у выборки из 6 сельскохозяйственных фермеров в Ташкенте, Узбекистан. Важные результаты исследования показали, что фермеры хорошо знакомы с принципами устойчивого сельского хозяйства и признают их значимость. Основными проблемами, с которыми сегодня сталкиваются сельскохозяйственные фермеры, являются деградация почвы, нехватка воды и технологические ограничения. С точки зрения экономической устойчивости фермеры больше обеспокоены финансовым состоянием и прибыльностью сельского хозяйства путём повышения объёма производства и производительности. Несмотря на осведомлённость о социально устойчивом сельском хозяйстве, два фермера по-прежнему используют традиционные методы выращивания сельскохозяйственных культур. Результаты показали, что не все выбранные фермеры являются социально устойчивыми. Некоторые из них внедрили принципы органического земледелия, чтобы сделать своё хозяйство более устойчивым, тогда как другие продолжают использовать традиционные методы ведения сельского хозяйства, которые являются неустойчивыми. Не все растениеводческие хозяйства эффективно использовали водные ресурсы. Они применяли традиционные системы орошения, которые приводят к потере водных ресурсов из-за испарения и впитывания воды в почву до того, как она достигнет сельскохозяйственных культур. Наконец, фермеры, занимающиеся животноводством, не использовали современные практики и технологии для эффективного управления своими хозяйствами и снижения риска загрязнения воздуха.

Ключевые слова: устойчивое сельское хозяйство, экономическая устойчивость, социальная устойчивость, экологическая устойчивость, Узбекистан

INTRODUCTION

Across the globe, countries have come to realize the pertinent need to protect the planet while still feeding their people, which has made sustainable agriculture a core focus worldwide. Concurrently, in Uzbekistan, the promotion of sustainable agriculture is a major task since it is a double landlocked republic dependent on the agricultural sector, which remains one of the important issues for the country’s long-term development for the long-term development of the country (Chen & Ryoo, 2025).

The agricultural sector is a major employer in Uzbekistan, being responsible for a significant part of its GDP. Yet, the environmental challenges associated with previous agricultural practices show how agricultural activities release pollutants. Due to this concern, Uzbekistan has introduced policy measures toward restoration and development by placing “green” growth and resilience at the center of its policies, including the Policy Objectives of Necessary Climate Actions in the Agriculture Sector 2020–2030. This strategy not only aims to enhance competitiveness but also to integrate all sustainability principles into agriculture (Juraev & Ahn, 2023). In addition to that, the country’s Strategy for Green Economy Transition is a significant contribution to environmentally friendly development (Rakhmonov, 2023).

In accordance with the UN Sustainable Development Goals (SDGs), which also include ending hunger and climate action, Uzbekistan is both researching and introducing a spectrum of agricultural practices. This literature review illustrates the consequences of these sustainability measures for the agricultural sector in Uzbekistan. It evaluates the environmental, economic, and social sustainability benefits of moving toward more sustainable agriculture by using current studies and reports. The evidence makes it clear that such practices produce positive results — from more efficient use of resources and increased productivity on farms to better market access — while at the same time pointing to the drawbacks in their adoption and policy support. The paper is scholarly in form and standards, integrating reputable sources with a batch of new references and offering an integrated and updated perspective on sustainability among Uzbek farmers.

Uzbekistan’s agricultural policy has shifted from centrally planned production to a market-oriented and sustainable green development paradigm over the last 10 years. In this case, the Agriculture Development Strategy 2020–2030 is a decisive factor, as it explicitly urges the modernization of agriculture through innovation, efficiency, and environmental sustainability (Juraev & Ahn, 2023). Important policy measures that will be

undertaken under this strategy and related reforms include liberalizing crop choices through diversification, investing in infrastructure such as drip irrigation and agro-logistic centers, and reforming input subsidy schemes to promote resource-efficient practices, for example, providing subsidies for water-saving technologies rather than subsidized water use. Besides, Uzbekistan is introducing a National Climate Change Strategy and updating its Nationally Determined Contributions (NDCs), which state that agriculture is a sector to be actively involved in mitigation and adaptation. Specific programs have been launched that partly align with these high-level commitments, for example, the Green Energy for Agriculture program, which promotes solar irrigation pumps among farmers and replaces fossil fuels with renewables.

LITERATURE REVIEW

Sustainability in agriculture has been at the center of attention in practice due to concerns about its negative consequences for the environment. So, what is sustainable agriculture? Pooniyan et al. (2023) define sustainable agriculture as utilizing agricultural practices based on ecological principles to meet the needs of contemporary people without compromising resources for future generations. Sarker et al. (2019) asserted that sustainable agriculture has become a challenging concept in recent decades because of concerns about growing agricultural products to meet the increasing needs of the population while protecting the environment. Thus, an important concept of sustainable agriculture is to implement agricultural practices that both increase farming profitability and ensure the sustainable use of resources without harming the environment.

An essential element of socially sustainable agriculture is to maximize the benefits and well-being of citizens by promoting healthy and nutritious food. In addition to food production, some authors argue that livestock farming is another crucial element in agriculture that should be sustainable. Grosso et al. (2020) stated that if livestock farming is not managed properly or sustainably, it causes foodborne diseases and environmental degradation. The concept is that animal welfare standards, responsible antibiotic use, and rotational grazing are essential for sustainable livestock agriculture (Grosso et al., 2020). These sustainable agricultural practices can not only reduce the risk of disease transmission but also contribute to producing healthier and safer food products for the population (Nuwarapaksha et al., 2023). Moreover, integrating livestock into underutilized lands can enhance food sources and improve agricultural income (Nuwarapaksha et al., 2023).

Pokharel et al. (2023) asserted the importance of sustainable agriculture in mitigating air pollution and, thus, promoting public health. In most cases, crop residues are burnt, which is a common practice in agriculture. Such practices are considered unsustainable because burning crop residues can release pollutants into the air, causing air pollution (Pokharel et al., 2023). Conservation tillage and cover cropping are more sustainable agricultural practices that can mitigate air pollution and promote respiratory health (Pokharel et al., 2023).

Another important principle of sustainable agriculture is to minimize its impact on the environment, including water usage, climate, soil, and biodiversity. McLaughlin and Kinzelbach (2015) stated that environmental sustainability in agriculture emphasizes securing universal access to clean water and sanitation management. Because agriculture consumes most water resources, improper management of water resources in crop irrigation can cause water scarcity and negative consequences for the ecosystem (McLaughlin and Kinzelbach, 2015). Therefore, practices and methods that ensure water efficiency are vital for sustainable agriculture. Obaideen et al. (2022) stated that conventional irrigation systems are inefficient in terms of water usage and can harm the soil. Therefore, sustainable agriculture should adopt water-efficient technologies, including drip irrigation and precision farming. Such practices improve water efficiency by directing water precisely to the crop root zone, which minimizes water losses and unnecessary evaporation (Obaideen et al., 2022). Furthermore, drip irrigation and precision farming promote better water conservation, resulting in increased crop yield and reduced overall negative impact on the environment (Evans and Sadler, 2008).

Another important concept of sustainable agriculture is preserving biodiversity and soil structure. According to Reith et al. (2021), the primary emphasis of environmental sustainability in agriculture is minimizing biodiversity loss and eliminating desertification. Moreover, Atapattu et al. (2024) stated that the ultimate goal of sustainable agriculture is to safeguard and restore ecosystems. In fact, sustainable agriculture must ensure minimal impact on the environment through biodiversity and ecosystem preservation. Nunes et al. (2023) stated that one of the sustainable agricultural practices adopted in recent years is agroforestry. Sustainable agriculture practices now integrate trees and shrubs into agricultural settings, which both preserves biodiversity and improves crop production. Moreover, environmentally responsible farming should emphasize agricultural practices that prevent land degradation and preserve biodiversity (Nunes et al., 2023).

Nunes et al. (2023) also stated that traditional tillage methods have negative consequences for the environment. Due to their inefficiency, they result in soil erosion, damage soil structure, and increase the risk of desertification. In fact, new methods of sustainable agriculture, including conservation tillage such as no-till farming, preserve soil structure and health (Nunes et al., 2023). Therefore, Shahmohamadloo et al. (2022) stated that conservation tillage can reduce soil erosion, support sustainable land management, prevent land degradation, and contribute to water conservation in addition to biodiversity conservation.

Several other authors emphasized the importance of sustainable agriculture in preserving natural resources and ecosystems. For instance, Power (2010) asserted that sustainable agriculture must preserve natural resources and ensure soil fertility, pollution-free production, and better pest management. Environmental sustainability is conserved when agriculture uses techniques such as crop rotation, cover cropping, reduced tillage, and better pest management (Redlich et al., 2021). In addition, the agroecological approach used in agriculture can improve cropping practices and reduce agroforestry loss. In fact, it reduces pollution, soil erosion, diseases, and pests by decreasing the use of harmful chemical inputs in agriculture (Nuwarapaksha et al., 2023).

By reviewing the existing literature, it becomes evident that sustainable agriculture has three pillars: economic, social, and environmental. These three pillars are the theoretical foundation of the current study. However, the existing literature has had limited focus on the case of Uzbekistan. Most academic papers with detailed analysis have focused on EU and Asian countries, with a lack of focus on Central Asian countries and Uzbekistan in particular. Moreover, there have been no comparative studies of sustainable agriculture with Uzbekistan facing sustainability challenges. Existing papers on Uzbekistan lack detailed analysis using interviews and in-depth examination of sustainability challenges. Therefore, this paper attempts to fill the gap in the literature and address sustainable agriculture in Uzbekistan based on three pillars: economic, social, and environmental.

RESEARCH METHODOLOGY

The research question examines what current sustainable agricultural practices exist in Uzbekistan and how agricultural practices are economically, socially, and environmentally sustainable in Uzbekistan. In this case, the study aims to collect data regarding farmers' experiences, behaviors, beliefs, attitudes, and motivation to adopt sustainable agricultural practices. An important research design associated with this research aim is the qualitative approach (Oranga and Matere, 2023). Therefore, a qualitative research design was adopted in this study.

Qualitative research design has several approaches to data collection. One of the methods is the interview. The interview research instrument is considered one of the popular types of qualitative data collection instruments. According to Ugwe and Eze (2023), the interview technique enables face-to-face interaction with participants and allows researchers to collect data regarding their behaviors, attitudes, and opinions. This study aims to collect farmers' experiences, behaviors, opinions, and attitudes toward sustainable agricultural practices and their willingness to adopt such practices. Therefore, the interview instrument enables the collection of qualitative data for an in-depth analysis of their behaviors and experiences. In fact, the interview technique was found to be the most suitable research instrument in this study.

Sampling is defined as the process of choosing a sample from a population, individual, or large group based on research aims and objectives (Makwana et al., 2023). Therefore, an important methodological approach to the research is to select participants using a sampling method. There are two sampling methods available in social research: probability and non-probability sampling methods. This study uses the non-probability sampling method. The non-probability sampling method is a method of selecting participants for a study when the likelihood of each member of the population being selected is not equal (Kumar, 2005). Because the study is focused on investigating only sustainable agriculture, it exclusively selects farmers who have experience in sustainable agricultural practices. Therefore, the non-probability sampling method is one of the suitable methods for selecting participants for the interview. A total of 6 in-depth interviews were conducted with selected agricultural farmers in the Tashkent region. The interviews were conducted by the interviewer through face-to-face interaction with participants during July 10–15, 2025.

The study aimed to analyze sustainable agricultural practices among 6 agricultural farmers selected for the study. Using interviews, an in-depth analysis was conducted regarding sustainable agricultural practices adopted by the selected interviewees. Prior to proceeding to the interview results, the study identified the key demographic characteristics of the selected participants. Table 1 illustrates the key demographic characteristics of the interview participants.

Table 1. Interviewee Demographics[1]

Interviewee No.	Gender	Farm Size	Type of Farming	Year of Experience
Respondent 1	Male	10 hectares	Crop farming	10
Respondent 2	Male	20 hectares	Crop farming	12
Respondent 3	Male	5 hectares	Orchard farming	7
Respondent 4	Male	7 hectares	Orchard farming	8
Respondent 5	Male	500 animals (cattle and cows)	Livestock farming	9
Respondent 6	Male	700 animals (cows, sheep)	Livestock farming	8

According to Table 1, all 6 farms are owned and managed by men. This indicates that there were no female farmers involved in the agricultural business in the selected region of Uzbekistan. Regarding farm size, all of the selected farmers for the survey are relatively large-scale. While crop and orchard farming land ranged from 5 to 20 hectares, livestock farmers had cows, cattle, and sheep ranging from 500 to 700. All of the farmers are highly experienced in agriculture. The years of experience of the selected farmers ranged from 7 to 12 years.

Analysis and Results

Economic sustainability deals with the financial viability, profitability, productivity, and financial health of agriculture (Berti and Mulligan, 2016). Therefore, an important principle of sustainable agriculture is to promote farmers' wealth, which can contribute to increasing their financial well-being and subsequently impact the improvement of local economies, the reduction of poverty, and the addressing of food shortages (Valkila, 2009).

The farmers selected for the interview were asked about how profitable their agricultural farming was. In this way, the study aimed to determine the financial health and productivity of the selected agricultural farmers and any techniques they used, including technology, to improve their output. Moreover, questions related to financial and non-financial support received from or available through the government were also asked to determine government support for sustainable agriculture in Uzbekistan. The results showed that two crop farmers had sufficient knowledge, education, and capacity to sustain their operations for a long time because of their adequate technology and financial health. These included the following:

Well, I think I have sufficient experience because I learned from my father, who was also a farmer. I inherited many machines and pieces of equipment, and I renewed some of them. I have sufficient technology to increase output. (Respondent 1)

When I started my farm, I had only a few machines and pieces of equipment. Now, see those machines. I think I have enough resources, and I have adequate knowledge. So, I achieve the desired outputs annually. (Respondent 2)

Productivity and output are also of greater concern to some of the farmers. This is especially true in the case of orchards. Orchard farming depends on weather conditions, as well as techniques and tools to maintain a high volume of fruit production. Therefore, non-financial support in terms of education and capacity building for orchard farmers is important to improve their output and productivity. These were as follows:

Orchard farming requires essential skills, you know. If you do not pay sufficient attention to them, they dry out and produce low outputs. I acquired the necessary skills and knowledge from Europe, where I imported those fruit trees. So, if you want to make orchard farming profitable and high-yielding, you should have relevant knowledge and skills. (Respondent 3)

Hmm, I regularly attend training courses organized by... I forgot the name of the company, but anyway, skills are necessary to make orchard farming profitable and high-yielding. And technology is also important. You should have technology to regularly cultivate the land of the orchard farm. (Respondent 4)

Finally, financial health is vital for livestock farming. Because livestock farming is a capital-intensive agricultural sector, access to adequate financial resources is vital for the long-term sustainability of agriculture. Therefore, two livestock farmers are more concerned about capital as a factor in the long-term success of their agricultural farms. The findings were as follows:

Cattle for meat and cows for milk require substantial capital to establish. If you do not have capital, you can receive credit from a bank on special terms. Personally, I received a loan and imported those cattle from the Netherlands. I can say, yes, I am earning good profits, but I will not tell you how much. (Respondent 5)

1 Source: Authors own findings

As you see, I have only cattle and sheep. I produce meat and sell it directly to butchers and meat processors, you know. Yes, it is a profitable business. The government has subsidies for livestock farmers, and you can get them on special terms. That makes your business bigger and more profitable. (Respondent 6)

The study aimed to examine sustainable agricultural practices based on three pillars: economic, social, and environmental. The primary objective of the research is to assess the existing sustainability levels in the nation's agricultural sector, identify obstacles to implementation, and ascertain whether these measures can enhance agricultural sustainability. Therefore, the study set research questions related to determining the current state of sustainable agriculture in Uzbekistan, how farmers adopt sustainable agricultural practices, and the challenges they face in these processes.

The study utilized a qualitative methodology to collect and analyze data. Using the interview technique, qualitative data were collected from a sample of 6 agricultural farmers in Tashkent, Uzbekistan. The important findings of the study showed that farmers are well familiar with and recognize sustainable agriculture principles. The findings showed some common values and perceptions about sustainable agriculture among the selected interviewees. These included protecting the air from pollution, water management, and food security. Because fresh water is scarce, using it efficiently and responsibly can reduce the risk of water scarcity and desertification. Moreover, two interviewees stated that the most important principle in sustainable agriculture is to produce food products that are safe and secure for the population.

Important challenges that agricultural farmers are facing today are soil degradation and water scarcity. Moreover, technology is also a major concern of the selected interviewees. Due to traditional and conventional technology, the implementation of sustainable agriculture may face constraints. Therefore, in order to properly implement sustainable agriculture, advanced technology, as well as advanced capacity building for farmers, is vital.

In terms of economic sustainability, farmers are more concerned about the financial health and profitability of farming by improving their output and productivity. Technology, capital, knowledge, and skills play vital roles in improving the profitability of agriculture. In fact, they put much effort into increasing their output and productivity in order to generate more income and become financially viable. However, these practices were often detrimental to social and environmental sustainability. While some agricultural farmers are concerned about food security and environmental degradation, there were some agricultural farmers who still use traditional farming methods and chemicals in their food production. Some farmers used mixed farming methods that use both organic and chemical inputs in their agriculture. However, while conscious of socially sustainable agriculture, two farmers are still using traditional methods to grow crops. According to their opinion, without chemicals, crop yields will be low. Therefore, they use them in sufficient amounts to control their crop yields. In addition, livestock farmers reported using mainly non-toxic feed inputs. Because they use non-toxic plants and other elements to feed their livestock, they believe the meat and milk they produce are more organic and less harmful to human health.

The results of the interview showed that the level of social sustainability varies among the selected farmers. While some of them adopted organic farming principles to make their farming more sustainable, there were some farmers who still use traditional farming methods that are less aligned with sustainability principles. However, there were also some farmers who use a hybrid method of farming that combines both organic and traditional farming methods. However, the justification for unsustainable agricultural practices was more concerned with the economic benefits of farmers and based on the belief that organic methods are ineffective in increasing crop yields. However, such practices may have adverse implications for food security and public health for food security and population health.

The findings showed that some soil management practices, such as crop rotation, are used by farmers. This showed that they are more concerned about soil fertility and, thus, use a variety of practices and techniques to maintain soil fertility and reduce the negative impact on the environment. However, not all crop-farming agricultural enterprises took advantage of the efficient use of water resources. They used traditional water systems that waste water resources due to evaporation and absorption into the soil before reaching the crops. In fact, the study found no evidence that precision farming is present in any of the farms, which is considered an unsustainable agricultural practice. Although livestock farmers stated that they effectively manage their livestock to reduce their impact on the environment, their practices are highly conventional. This indicates that advanced practices and techniques were not observed among the interviewed livestock farmers and techniques to effectively manage their farms and reduce the risk of air pollution. Advanced practices, including rotational grazing, improved feeding regimes, and manure management, contribute to reducing greenhouse gas emissions from livestock farms.

CONCLUSION AND SUGGESTIONS

Though this research reveals a lot of information about the adoption and perception of sustainability practices in Uzbekistan, it has some limitations as well. The main data were gathered through focus groups; that is, even though they are rich in depth and interaction, they represent only a small part of the total farming population. The results, therefore, cannot be statistically generalized across the entire agricultural sector. Besides, even though the sample size — ten participants — was adequate for thematic saturation in qualitative research, additional triangulation with a wider range of survey data would have strengthened the findings.

Another limitation is that self-reporting biases might occur. Participants might have given answers that are socially desirable, especially when it comes to environmentally friendly practices or the government's strategies. Moreover, a few stakeholders, especially those who do not have digital literacy skills or who are from the most remote territories, may not have been adequately included.

Finally, despite the study's inclusion of regional diversity, the findings are limited to a specific period, as climate change and the policy context are both dynamic and evolving. Future research must continue to track changes over time to determine the true depth and durability of the sustainability transition.

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